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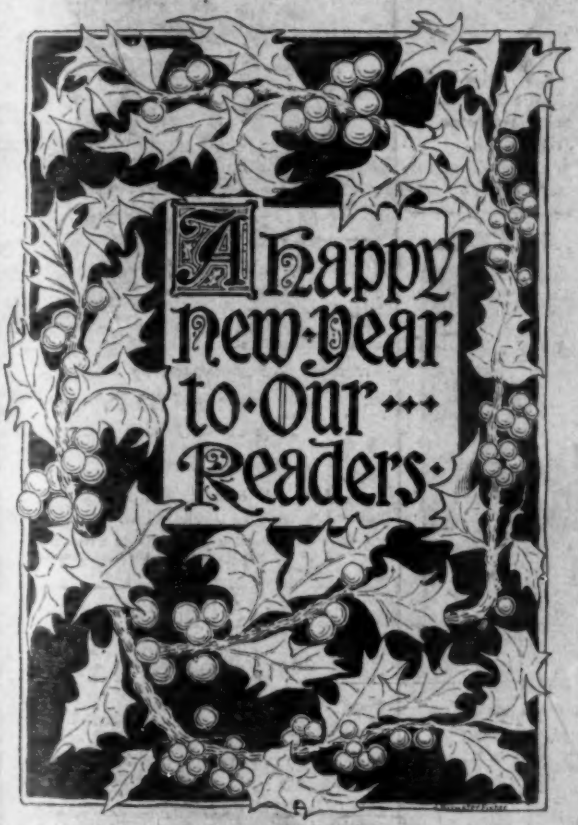

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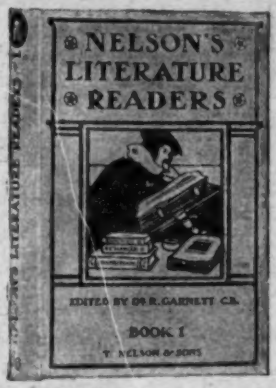

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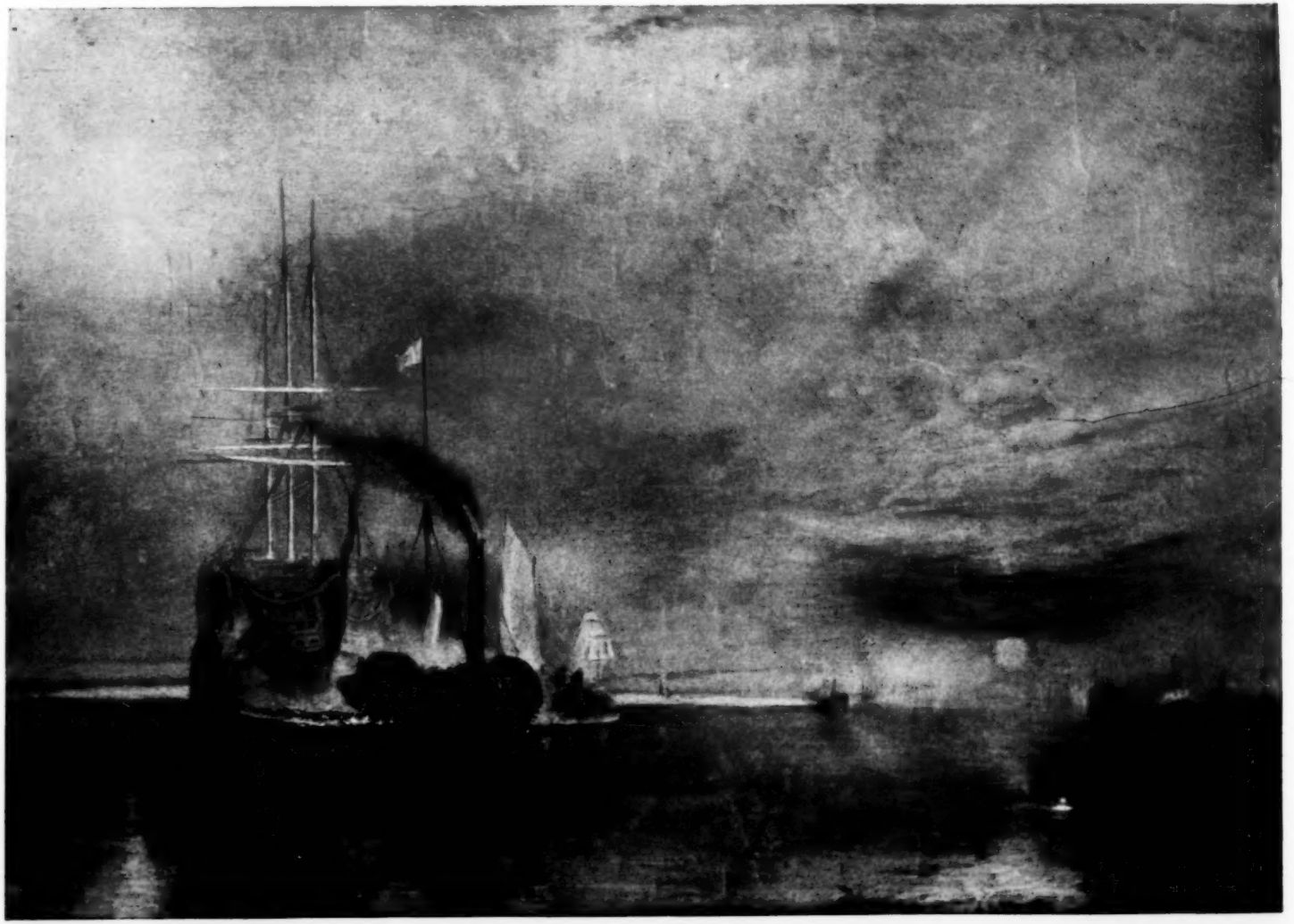

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THE PRACTICAL TEACHER

A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

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EDUCATION IN PARLIAMENT—NOVEMBER-DECEMBER.

IT is desirable, but impracticable, to keep up the parallel presentment of the Education Bill as it was and is which was begun in these columns some months ago, and was "continued in our last." Impracticable it is because since our last the Bill has been pushed along with ever-increasing speed. Just as the Jehu of a hired "growler" paces slowly through the streets his horse, but upon sight of a "gentleman's house" as the goal of the journey whips up his Rosinante to a brief spurt of speed and imposing pull-up on the gravel sweep, so in the end the Bill was driven at a rattling pace through the House of Commons; or, to change the simile, the rolling stone gathered momentum, and also, strange to say, it gathered moss. For beginning life as a foolscap pamphlet of ten pages or so, it ended by being twenty-five, so that an unfair share of the pages of this magazine must be taken up by it were one to print in parallel columns all that the Bill has been and all it is.

Considered as a piece of legislation, the Bill is even then something portentous. The memory of the oldest inhabitant of Parliament can hardly recall a Bill that has been debated for so long. Even the massive Home Rule Bill of 1893, involving such vast and vital changes in the government of the United Kingdom, escaped from Committee ten days earlier than *this* Bill. Think of the dates for a moment. The first reading in the House of Commons took place on March 24. Easter intervened; then the second reading took from May 5 to May 8, inclusive. From June 2 to August 12 the main Parliamentary dish, week by week, was Committee on the Education Bill. On October 16 the same meal began again, and day after day successively, almost without a break in days, and from 2.30 to 7.30 and 9 till midnight, day after day, the Bill was fagged at in Committee until November 21. From November 21 to 28, inclusive, the "report stage" occupied the wearied legislators, and on December 2 and 3 the third reading was discussed. Let any reader who has experience of a debating society imagine what it would mean for the same subject to be discussed by the same speakers, very often in the same old speeches, for such a terrible time as that! Never was there such a time before.

The twenty-five pages of the Bill contain twenty-six clauses and four schedules. We left the Bill last month at Clause 18. Important changes have been made in the remainder of the measure. It has become not only a portentous piece of legislation, but a far-reaching measure of educational reconstruction. The claims of the populous poor boroughs, ably voiced by Mr. Gray, eked out by the bitter cry of the distressed agriculturist in the rustic areas, obtained the addition of something like half a million more state grant to the gain of £900,000 already obtained from the national exchequer. How vital this was will be seen upon reflection that the grave danger was a levelling down of the Board school income, in order to increase the denominational school income without adding largely to the rates. Consequent upon this more generous grant was a change whereby the minimum sum payable by the locality is to be, not "one-fourth" of the total income (as the Bill prescribed before), but "not less than the amount which would be produced by a rate of threepence in the pound." The worst of this particular arbitrary minimum—of course, any minimum of the kind could not but be arbitrary

THE BEST NEW YEAR'S PRESENT
FOR A YOUNG TEACHER:
THE PRACTICAL TEACHER'S ART MONTHLY,
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—is that it suggests the oft-misquoted words of Mr. Forster and Lord Salisbury's advice to write threepence in the pound in letters two feet high on every Board school wall.

Two long debates took place upon what has come to be known as the Kenyon-Slaney amendment. Education Bills seem to be fruitful in famous additions associated with a double-barrelled name. The Bill of 1870 got its interpolation of the Cowper-Temple clause; the Bill of 1902 got its interpolation of the Kenyon-Slaney clause. Colonel Kenyon-Slaney does not look at all the theologian; the double-barrel of the sporting-rifle seems a good deal more in his line. His double-barrel has been highly effective. Aiming at the Anglican parish priest, it hit the bishop also, or at least was at first thought so to do. Later on it was explained that the control of the managers over religious education in denominational schools, which the clause affirmed, was not to be taken as eliminating the bishop as the last resort and court of appeal. What the clause really will do remains to be seen in practice. The lawyers differed about its meaning more than lawyers in the House usually do, which is saying a good deal. The immediate effect of the clause has been to disaffect some forty clerically-minded members of the House of Commons from a warm support of the Bill; and on the report stage the spectacle was seen of High Church Lord Hugh Cecil, Low Church Mr. Cripps, and Roman Catholic Mr. Healy all agreeing and bemoaning that the Bill would be the ruin of denominational schools. The teacher members listened with the pleasure of prophets justified even in their own country. "What did I tell you?" their faces seemed to say, as they turned them towards confidants who had listened to such a prophecy months ago.

However, the inner meaning of the Kenyon-Slaney Clause is not so much educational as politico-ecclesiastical. It represents a certain antagonism general among members of Parliament—among Unionist members as much or more than among the others—towards the fussy, pompous, interfering, unctuously professional parson, who insists on being regarded as "*the* person of the parish." But it represents also a side-hit at Ritualism in the Established Church. "You may say and do what you like in the pulpit and at the altar," the clause means, as an utterance of the average M.P., "but you shall not introduce your aping of Roman Catholicism into the schools." And Mr. Balfour, in his remarkable speech which closed the debate, put this feeling finely when he declared that the school was a prolongation of the family and not an annexe of the Church.

Mr. Yoxall was perhaps the earliest to hint at this question. Rising to vindicate teachers from the charge that they coerced Nonconformist children for the proselytism of the Establishment, he said that the real difficulty was beginning to be, not between Episcopal and Dissenter, but between High Church and Low Church. He told the history of a recent dispute, wherein the experienced and respected Low Church teacher was found by the new High Church clergyman to be informing the children that the sacraments numbered two. "Seven!" said the parson. "Two!" said the teacher. "Three months' notice!" said the parson.

> "Falsely your church seven sacraments doth name,
> Penance and matrimony are the same,"

Mr. Yoxall quoted from Hood at the clergyman. But there the Chairman of Committees pulled the speaker up.

The other day Mr. Arnold-Forster facetiously observed at a public dinner that during the debates on this Bill somebody had once talked about education; and although the House seemed horrified, he was not called to order for the offence. There is much truth in this jibe: except for Dr. Macnamara and the other two, education has been one of the last things to be considered and mentioned in these debates. Up to the end—the very end of the period possible—on the report stage itself, Mr. Gray, Mr. Yoxall, and Dr. Macnamara secured amendments which told in favour of the schools—brands plucked from the burning at the eleventh hour—gains the weight and import of which only the educationist can judge. The three have moulded the Bill at almost every point, indeed.

Closure and "the guillotine," late hours, long, weary tramps through the division lobbies, and what not, were used in order to bring this long debate and "high argument" to an end. Many a small point lies in a Bill so carried which contains quite unsuspected germs. Half the Bill was never adequately discussed, after all. The question of the position of voluntary school teachers who may suffer pecuniarily by the change was closured and guillotined out of the Chamber. One hears that extraordinary efforts were made to obtain the prospect of justice for such teachers. By some hundreds of M.P.'s personal representations—private, of course, because this part of the Bill was never under public discussion—were made to members and officials of the Government, but all in vain—at least while the Bill was in the Commons. The Voluntary school teachers have little in this respect to thank the Government for, and it was shrewdly said in the lobby that the Government do not *wish* that it shall be made legal and convenient for a Voluntary school to be closed without loss to its teachers. It is probably true that nine out of ten of the Voluntary school teachers will not suffer; but what is likely to happen, in a cited case, where a Voluntary school teacher in a borough is receiving £400 a year while the maximum Board school salary in the borough is £240, is, of course, the local authority seeking to make the £400 descend to £240, and the teacher who suffers will have no guarantee against that, unless a compensation clause be inserted in the Bill by the House of Lords.

THESE paragraphs go to press before the decisions of the House of Lords are known. A midnight assembly of peers took place to receive the Bill immediately after its passage through the House of Commons. The Bill was read a third time in the popular House by a large majority, and Mr. Balfour received the ovation he deserved for his steady, industrious, skilful, and earnest dealings with the measure. It was nothing short of a piece of great good fortune that when a big Education Bill really came up for discussion and legislation, the Prime Minister should be a Scot and a Presbyterian rather than an English Churchman. Standing detached, as Mr. Balfour did, he was able to exercise strict impartiality as between the Voluntary system and the Board system. It is necessary to add that he has all along received the wise and unflagging help of Mr. Morant, as representing the Board of Education.

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AMIDST loud cheering the Bill passed into the House of Lords, where a few somniferous, and almost somnambulous, peers received it and gave it a first reading in the twink of an eye. On the following day the Gilded Chamber presented a scene of colour and life when the second reading was taken. The Duke of Devonshire spoke for an hour and a half: at last the Duke has got his promised Education Bill, though it is one very different from any of the schemes his Grace excogitated himself. Sir William Anson watched the proceedings, but Sir John Gorst did not. One of the reputations which have gone down in the long struggle is Sir John's. He absented himself from the third reading in the House of Commons, and he may now be regarded as a spent force. Sir William Anson, on the contrary, has distinctly improved his position, and everybody expects to see him prove a very good Parliamentary Secretary to the Board of Education indeed.

A TRAGICAL feature in the Peers' debate was the illness of the Primate of all England. The old man with the strong, set, almost Richard-the-Crookback-looking features, never moved a line of them while Lord Spencer paid a tribute to his work for education in days "when he was only Dr. Temple." Later, when the Archbishop rose, his tongue failed him again and again; he broke off, left a sentence unfinished, sank to the crimson bench, and clutching the oaken end of it rose again manfully to bring his speech to a speedy close. Then the other prelates helped him away, as they did from his obeisance before the throne in Westminster Abbey on August 9th. Such sights as these, and such reflections on change as are dealt with in the preceding paragraphs, are the things which make the moving show at Westminster a drama, and sometimes a tragedy indeed. But there are wider considerations yet. Vision, free from the petty and immediate surroundings which sometimes turn that drama into farce, shows one the multitude and great congregation of children awaiting the boons which this Bill is likely to bring. Millions of children, generation after generation of them, the line stretching away to the crack of doom, will benefit by the fruits of the long toil and warring struggle of the months that are past.

BY MANY HANDS.

"Quot homines, tot sententiæ."

WHATEVER the universal language is going to be—Pidgin English, Volapuk, or Esperanto—it should hurry up. The efforts of hotel-keepers and others on the Continent to make known the attractions of their establishments to the numerous travellers of Anglo-Saxon origin whom they desire to catch are fast tending towards the point where something must happen. It is of no use saying, like Mark Twain to the German waiter who tried to understand the humorist's German, "Don't strain; it is of no consequence." They *will* strain, for they are in deadly earnest, and then they produce something like the following, which was handed to us a few months ago outside the gates of Pompeii, a spot where, at all seasons, competition for the favours of the sightseer perilously approaches the breaking point. Guides and coachmen in any place of resort have preferences for certain houses of call, and never lose a chance of a little personal commercial transaction with the hotel-keeper on their own account. The Italian "cocchieri" are not less commercially inclined than their brethren elsewhere, and so at Pompeii the proprietor of a Swiss hotel adjures the globe-trotter in these terms:—

Advance, Esperanto!

"Beivare of un scrupolous guides and coachmen, in ivhom not the stinghtest faitch can be placed."

This sounds like an awful aspersion on the character of Jehu, but perhaps the proprietor has travelled in England and discovered that unique creature the hansom cabby. Quaint as are his language and orthography, his warning breathes sincerity. But how much neater his announcement would have been, and how much easier of comprehension, were the universal language a fact!

TALKING of language brings up another thought. While waiting for the millennial Volapuk we had better take care of our native idiom, and here teachers have a great responsibility. The "man in the street," we are told, is the final arbiter of our speech, just as Malherbe told the neologising writers and grammarians of the sixteenth century to go to the porters of the Pont-Neuf for pure French. Well, the man in the street has almost knocked the subjunctive after the conjunction "if" into the grammatical limbo, and is doing his best to make "between you and *I*" (oh, horror!) pass current, besides leaving his inelegant impress on the language in other ways. But when this ubiquitous individual tries to corrupt the meaning of useful terms by applying them falsely to cases already admirably fitted with significant terms, it is time to protest, and high time for teachers to be on their guard to protect the purity of the English tongue. For example, the lexicographer of the street no longer says that such and such a thing is very bad; he says it is "chronic," wilfully oblivious of the fact that a chronic state is merely one that is confirmed or lasting. Again, anything that is big or astonishing to the pure-speaking layman is "phenomenal" to our linguist of the side-walk. He apparently refuses to remember that "phenomenal" is merely "apparent." He perhaps thinks that so big a word must have a colossal significance.

The Man in the Street—

BUT the worst embellishment of our mother-tongue introduced by this ubiquitous word-damager is his novel use of the word "connote." This is a logical term, and means "to imply," "to indicate the possession of certain qualities;" but in this sense it is quite unknown to the arbiter of our language. For now he tells us, with infinite gusto, some such thing as the following: "Education is the right of everybody, though it has taken centuries for Englishmen to *connote* the fact." Shades of Aristotle, Duns Scotus, Thomas Aquinas, and every logician down to Stanley Jevons! "To connote" is now taken to mean "to realise," "to understand"! The force of ignorance can no further go, for such freaks as we

And his Divagations.

have mentioned are the result of ignorance, pure and unadulterated. To be a purist in language is equivalent in this age of heterogeneous and garbled speech to set oneself up for a pedant. But at the risk of being called pedantic, it behoves us all to see to it that our sturdy, supple English language remains true coin, and does not become a debased currency. We have adduced but a few glaring instances; the memories of our readers will supply many others, and justify us in calling on English teachers to do what they can to maintain the purity of the English tongue.

MUCH has been heard of recent years concerning extraneous duties, and the hateful phrase has even re-echoed of late from the walls of the Parliament House at Westminster. That these duties are no new thing the extracts we have given from time to time from the contracts of schoolmasters of past years prove completely. We have yet another contract dating from 1763, in which there are some piquant details concerning duties which were then regarded as quite otherwise than extraneous—they were made a condition of office. Sweeping the church and keeping the sacristy in order were among this lowly dominie's functions. Also he was the vicar's assistant in every vicarial function, and naturally was made responsible for the modest behaviour of the youth of the village when in church. But further, he had to ring the bells whenever a thunderstorm threatened—a sufficiently embarrassing and quite extraneous performance to our twentieth-century eyes. And lastly, the contract deigning to cast an eye on his pedagogical functions, he was to keep school in a decent place, removed from the spot where he carried on his trade of wooden-shoe maker. Truly the patience of this worthy pedagogue must have been of an enduring kind. Spite of the eighteenth century being destitute of N.U.T.'s and teachers' M.P.'s, one wonders that the village dominies of the time did not rise in person in a crusade against "extraneous duties."

Extraneous Duties in the good old Times.

WITH OUR CHILDREN.

THE doctrines preached in this column from time to time are making headway, if slowly. The latest addition to the roll of educational leaders in the metropolis, Professor Adams, is "sound in the fundamentals" of child-study, while not to be described as one of the "fanatics of child-study" (the phrase is that of another professor of education of a somewhat different type). In a report on the Protestant School System of Quebec, just issued by Professor Adams, he says regarding the M'Gill Normal School, "One misses some of the newer methods of child observation." Of how many of our British normal schools could this remark be made otherwise than in irony? The difficulty would rather be to "hit" among them any of the newer methods of child observation. We shall have made much progress before the absence of child-study in a training college will be thought worthy of remark.

Professor Adams.

WE may quote another sentence or two from the same page with reference to the plan of making the students themselves represent a class of children to be taught by one of their number. "The teaching student must modify her teaching to suit the needs of the prescribed class, and the students who form the class must exercise all their ingenuity in trying to follow the lesson and to answer the teachers' questions *as pupils of the prescribed age would*. It is found that the students who are being taught have at least as difficult a task as the student teaching. As the fundamental need of a teacher is the power to regard things from the pupil's point of view, this exercise is of the first importance in any course of training for teachers. The educator who cannot project himself into the personality of his pupils has not learnt the alphabet of his profession." There may be another side to this form of exercise which would modify our views of its utility, but the important point to note here is the reason given in justification of the plan. We may describe it as a striking novelty, and even as the germ of a desirable revolution in many of our educational views and methods, when one in Professor Adams's position with regard to the training of teachers thus proclaims that a thorough knowledge of children, acquired by means of regular study, is the essential thing in the teacher's training.

A Further Quotation.

THE various branches of the British Child-Study Association are again bestirring themselves in view of their winter programme. Dr. Fletcher Beach gave his presidential address to the London Branch at their November meeting, and in his review of the past year's work there was much on which the members may congratulate themselves. The membership is over two hundred, and among those added recently are such well-known educationists as Mr. Russell, headmaster of the King Alfred School; Professor W. Rippman, Queen's College; J. Olven, Inspector of Schools, Denmark; Miss Forchhammer, Copenhagen; Professor Levinstein, Leipzig; Dr. Birch Caley, Sheffield; and Miss Grace Browne, Massiourie Training School, India; while Professors Earl Barnes and Will S. Monroe of America are honorary members. We congratulate the branch on their roll, both as to quantity and quality.

London Branch, B.C.S.A.

DR. FLETCHER BEACH gave some valuable advice as to the necessity for the study of the brain by teachers. After describing briefly its structure and functions, he pointed out the necessity for such conditions as are favourable to healthy brain action—nutrition and fresh air especially—and showed that brain development in education proceeds along three distinct lines. The sensory centres are developed by exercise of the senses; the motor centres depend for their growth on co-ordinated muscular activity; the associating and connecting fibres develop through the associative activities which form a great part of educative work. His position may be summed up in the sentence, "Scientists must continue to unite with educationalists in endeavouring to elucidate the working of the minds of children." We could wish there were more justification for the word "continue;" but for the example of a few enlightened men of science, such as Dr. Fletcher Beach himself, we should incline to change his sentence and make it read, "Scientists must *begin* to unite with educationalists."

Brain Development.

EDINBURGH Branch opened its session with a paper by Dr. J. Gunn on "Periods in the Growth of Children." The general thesis was that growth is not

uniform in children, but shows changes in direction and characteristics, both as regards the mental and the physical, and that the school curriculum should be designed so that each instinct and capacity may be developed and utilised during its flowering time, and not earlier or later. The study of "nascent periods" in growth is now being generally recognised, especially in America, as a branch of child-study which has special value to teachers.

Edinburgh Branch, B.C.S.A.

SPECIAL note was taken of the physical and mental characteristics of the infant-school period, previous to the change which takes place about the time of the second dentition. It is a time of constant movement—activity for its own sake, or play, not activity for some other end, or work. Only the larger muscles are under control of the brain; hence reading, writing, drawing on a small scale, and fine kindergarten exercises are out of place; fine adjustments come naturally when the brain has further developed. Time spent on them at this stage is largely wasted. As to instincts, imitation is at its strongest. In formal school work the subject which is most purely imitative is language—oral speech, not written or printed. Hence the importance of abundant exercises in hearing and in speaking good English during those years. Habits of accent and sentence-construction thus learned become a permanent acquisition, but are only really acquired through much more practice in actual speaking than most infant schools provide. Reference was made to the characteristics in which the "boy" differs from the "infant," and inferences were drawn as to the proper age for introducing accurate handwork, memory work, drill, team-games, and the like. This whole subject is one that will repay study by members of the B.C.S.A. who are engaged in school work.

The "Infant" and the "Boy."

J. G.

N.U.T. NOTES.

THIS is a "record-breaking" age; and the Council of the Benevolent and Orphan Fund of the N.U.T. established a new record for itself by holding its November meeting at Page Hall, Sheffield, the delightful mansion secured by the wise forethought of the Sheffield teachers for the purposes of the Girls' Orphanage. Page Hall cannot, of course, be compared with the magnificent Passmore-Edwardes Home at Sydenham, yet it has undoubted charms of its own. And the children whose lot it is to be cared for by the public-spirited Sheffield teachers always look so bright and happy, contented and well cared for, that any Unionist whose good fortune it is to see them departs with the reflection that, were he to fall by the way and circumstances demand it, he would desire no better refuge for his orphan girls than Page Hall. This home is at present on the outskirts of Sheffield, but there is abundant evidence that before a decade has passed it will be surrounded by a busy and thriving population. Whether the Council will then be tempted to dispose of part of the extensive grounds attached, or whether they will sell the whole estate and go still further out, time will show. But as an investment alone—to say nothing of its present utility—Page Hall undoubtedly stands high. The ordinary Council business was all disposed of before luncheon was taken, and the afternoon given up to strolling in the grounds, chatting with our little *protegées*, and meeting the members of the House Committee. Shortly before 4 p.m. a very large company gathered in one of the rooms of the hall, for the purpose of paying some slight tribute of gratitude and esteem to Dr. Robinson, who had been our honorary medical officer for the past fifteen years. Some felicitous little speeches were delivered by Miss Cleghorn, Messrs. Laycock and Champley, after which Mr. South, the genial chairman of the Central Council, asked Dr. Robinson to accept at our hands a very beautiful dressing-case. The vice-president of the Union having added a few well-chosen words, Dr. Robinson, who received an ovation, responded modestly and in feeling terms. Whether the Council will make its visit to Sheffield a yearly function remains to be seen, but there can be no two opinions as to the successful arrangements made by our kind Sheffield friends to render the occasion a red-letter day in the annals of the Home.

The Council at Sheffield.

IN the main, the regulations of School Boards which deal with absence of teachers from duty, owing to illness, are eminently reasonable and satisfactory. Most of the prominent Boards allow payment of full salary for the first month, and either the whole or part salary for a second month, at the same time reserving the right to deal specially with the cases of individual teachers whose illnesses are of a prolonged character. It is, I take it, generally recognised that teachers are, by the nature of their occupation, peculiarly liable to attract any epidemic that is prevalent. Frequently they labour in crowded classrooms, improperly ventilated and inadequately heated, whilst in poor districts the children's clothing has not always the sweetest of odours. To a considerable extent the lives of teachers are "picked" or "selected," for throughout their professional training and apprenticeship they undergo a series of medical examinations. Now and then one comes across a Board whose members are either unduly suspicious, or do not, apparently, possess the normal amount of the "milk of human kindness" and sympathy. When this is the case, no very great surprise can be evinced at the existence of regulations similar to the following:—

School Boards and Sickness.

> (*a*) "After ten consecutive school days' absence on account of illness, the Board may find a substitute at the expense of the teacher absent. *If a substitute be appointed, the salary paid shall be deducted from the salary payable to the teacher who is absent.*"
>
> (*b*) "After seven days' absence on account of illness, a medical certificate shall be forwarded without delay to the clerk; and after one month's absence from duty from any cause, salary shall cease from the expiration of such period until duty in the school be resumed: *after two months' absence from duty from any cause, the engagement with the Board shall terminate without notice on either side.*"

Nothing more harsh or arbitrary could be devised were teachers malingerers of a pronounced order. My experience of nearly thirty years enables me to state, without any fear of contradiction, that so far from feigning sickness in order to avoid duty, teachers ought frequently to be resting at home, when their high sense of duty has caused them to turn out for their professional obligations.

THE Education Bill of 1902, which will eventually revolutionise our educational (want of) system, will probably, at no distant date, materially alter the

internal organisation of the N.U.T. Many representations have already reached Russell Square on the subject, and experienced men are drawing up schemes applicable to typical rural, semi-rural, and manufacturing counties. The difficulties to be surmounted are not by any means small. Even in the county boroughs, where there will exist the *one authority* for all grades of education, it is not plain sailing. For every one of these has a large rural fringe, whose members have for thirty years been accustomed to meet their oppidan colleagues in order to discuss professional problems. These rural teachers will undoubtedly desire to be in touch with their fellows under the administration of the County Councils. At the same time, sentiment and old associations will prompt them to remain in the local branch of the N.U.T., to which they are accustomed. The Executive will probably elect to "hasten slowly" with any scheme of reorganisation. My opinion is that whatever happens to the local associations, the District Unions must inevitably suffer a great change, except in the very rare cases wherein their areas coincide with those of the County Councils, which, after March next, will undertake the herculean task of evolving order out of educational chaos.

County Organisations under the Bill.

* * *

AT the time of penning these "Notes" but two candidates are in the field for the Blue Ribbon of the Union. As everybody knows, these are Mr. T. H. Jones, Chairman of the Tenure Committee, and Mr. George Sharples, Chairman of the Education Committee. Possibly I am right when I say that never in the history of the Union have two more excellent candidates been before the members than the two whose names are here given.

The "V.-P." Candidates.

* * *

HOW very frequently does one hear the complaint that "Conference is far too big!" And yet how magnificently does it demonstrate to the intelligent outsider the power and importance of the Union. Many attempts have been made in the past to bring down the size to what are termed "reasonable dimensions," and failure has been the inevitable result. For one thing, folks *like* to attend Conference, and in some of the larger associations the competition when representatives are chosen is decidedly keen. Perhaps it does seem a little unfair that an association of a hundred members can, under the rules, elect as many delegates as one of a thousand or thirteen hundred. Yet probably the large association whose membership exceeds a thousand would, in the majority of instances, decide to have no more than ten representatives. Fifteen hundred ladies and gentlemen are just as effective, as a deliberative body, as *half* the number would be, and (I speak feelingly here) are simply invaluable in assisting the president to maintain order. There is a degree of *morale* about a big assembly quite impossible to secure when the numbers are small. Provincial teachers enamoured of the idea of altering the size of Conference must not forget that London is the chief sufferer under the present rules.

A. G.

Size of Conference.

NOTES FROM THE NORTH.

THE Annual Congress of the Educational Institute is usually held in the chief centre of the district from which the president for the year has been chosen, and this year is no exception. As in 1895, the last occasion on which the Congress was held in Glasgow, the splendid Bute Hall, belonging to the University, has been secured as the place of meeting. No better place could be got, as there is not only ample accommodation for the members attending, but also for what is perhaps not less important, the publishers' exhibits. To suit the holidays, which in Scotland are either Christmas or New Year's week, the 29th and 30th December have been fixed as the dates. The Institute is again fortunate in having the patronage of the University and the Town Council. Principal Story, on behalf of the former, will welcome the Congress; while the latter will be represented by Lord Provost Primrose, whose wife, it is interesting to note, was at one time a teacher. I have been favoured with an advance copy of the arrangements, and they indicate much labour and effort on behalf of the committee. The papers, I note, are to be fewer in number, so that time and opportunity will thus be given for adequate discussion. Previous congresses have suffered very largely from a surfeit of addresses, more or less lengthy, and it is time that this unfortunate tradition was broken through. The resolutions which accompanied the papers, too, were not infrequently introduced by speeches as long as the papers, with the result that little, if any, time was given for the "floor" to speak.

The E.I.S. Congress.

* * *

ON the first day of Congress, Mr. Thomas Shaw, K.C., M.P., has the place of honour after the president's opening address. Than Mr. Shaw there is probably no one in Scotland better entitled to speak on the subject of education. He has for many years taken a deep interest in the question, and is a member of the Carnegie Trust. At the forenoon sederunt, too, the "foreign" delegates are to be received, and a warm welcome, no doubt, will be extended to Messrs. Croft and Coward of the N.U.T. The opening address of the second day is to be given by Mr. Sadler, of the English Board of Education, and Scottish teachers will be deeply interested to hear one who has "reported" so well. The ladies' paper has been entrusted to Dr. Marion Gilchrist, who will take for her subject "The Eyesight of School Children." At the afternoon sederunt, Mr. J. Beattie, Oban High School, will discuss "Rural Schools;" and Mr. G. Fenton, vice-president of the Institute, will deal with the thorny question of "Continuation Schools." Resolutions will in nearly all cases follow the papers, among which I note Tenure, Superannuation, Continuation Schools, and Leaving Certificates.

The Programme.

* * *

ON the Monday the School Board of Glasgow are to give a reception in one of their most recently-built schools, Provanside Public School. In the evening the usual "spate" of oratory will follow the dinner, which is to be held in the Grand Hotel. On the Tuesday the Scottish Class Teachers' Association will hold their annual breakfast, under the presidency of Mr. Charles Scott Dickson, K.C., Solicitor-General for Scotland. In the interval of the second day Mr. Croft, the genial president of the N.U.T., is to be entertained to lunch by the Scottish class teachers, in recognition of the eminent services he has rendered, not only to the class-teacher movement, but also to education. At this function Sir John Stirling Maxwell, M.P., is to preside, and I feel confi-

Congress Adjuncts.

dent that a right hearty Scottish welcome will be accorded to Mr. Croft. On the Wednesday visits have been arranged to Glasgow Cathedral, the Art Galleries, Glasgow and Govan schools, and several manufacturing establishments. The handbook of the Congress is to be the work of Messrs. Blackie and Son, and will contain, among other useful matters, an article on Glasgow by Mr. Alexander, clerk to the Glasgow School Board.

* * *

Is it to be an "Ad Hoc" Authority?

AS was to be expected, the somewhat cryptic utterances of Lord Balfour of Burleigh with reference to the Scottish Education Bill have given rise to a crop of surmises and rumours. But the two chief questions that interest us as teachers are, When are we to have the Bill? and, What is to be the authority? The well-informed London correspondent of *The Scotsman* says that we are to have an *ad hoc* authority. This, we may say, is the desire of the Institute. At a recent meeting of the Education Committee the subject came up for discussion, and the *ad hoc* authority carried the day. So far the Institute has made no public statement of its wishes, but no doubt it will soon do so. The areas are to be enlarged, and we are to have a special educational council. We hope rumour in this case is not false. The press of Scotland so far seems agreed that we shall have to wait for the Bill until 1904. Lord Balfour's words, however, are hardly capable of this interpretation. The new equivalent grant that falls to Scotland as the result of the English Education Bill will have to find a place in Scotland's educational finances, and so Lord Balfour thinks *now* is the time to make the best use of this grant. This looks like action in the very near future, possibly 1903.

* * *

Landed Proprietors and Attendance.

IN the Blue Book for 1901–2, Mr. Harvey, H.M.I. in the Wigtownshire district, especially complains that landed proprietors and their factors, instead of using their great social influence to further regularity of attendance, not only encourage the farmers in the illegal employment of children, but are often themselves the most flagrant law-breakers. This statement has led to some correspondence between the Education Department and Mr. Stair M'Harrie, who says that Mr. Harvey has held this class up to public opprobrium in most pointed language, and asks him to furnish proof or withdraw and apologise. The Education Department, however, maintains that this impression is not confined to Mr. Harvey, but prevails in regard to other districts, and is consistent with a large body of evidence tending in the same direction.

* * *

Free Kindergartens for City Children.

IT is proposed to institute a Free Kindergarten in Edinburgh, and a provisional committee has been appointed to take up the question. They have issued a short statement of the plan proposed, and are anxious to secure subscriptions to enable them to go forward with the experiment. They propose to rent a small house or hall in one of the poorer districts, with access to a green or yard if possible, to secure the services of a fully trained and experienced kindergarten mistress, and to select for the kindergarten a limited number of the most needy children in the neighbourhood. Both before the Edinburgh branch of the Institute and the Moray House Club Miss H. Beck, Milton House School, Edinburgh, has pleaded for the scheme, and it would seem as if her efforts were to be crowned with success. The aim of the kindergarten is to make the lives of the children between three and five years of age happier, and to surround them with an atmosphere favourable to the growth of moral character.

* * *

The Late Dr. Alexander Mackay.

A WIDE circle of teachers and educationists, both in Scotland and England, will learn with great regret of the very sudden death of Dr. Alexander Mackay, general treasurer of the Educational Institute of Scotland and editor of *The Educational News*. His death took place on Thursday, 4th December, at the quiet Border town of Peebles, whither he had gone a few days before in the hope of recruiting his health.

Dr. Mackay was born in 1833 at Bonar Bridge, Sutherlandshire, and received his early education at the parish school. On completing his studies there, he proceeded to St. Andrews University, where he graduated with the degree of M.A. His first appointment was to the little school of Cameron, Fifeshire. After a short time in that position, he was appointed parochial schoolmaster of Torryburn, near Dunfermline. His work there was of the highest order, and many of his former pupils still testify to the enthusiasm and thoroughness with which he fulfilled his duties. He specially devoted himself to the work of equipping lads for service in the Colonies.

Dr. Mackay, however, is best known in connection with his services to the Educational Institute. In 1876 he was appointed treasurer, and this office he has occupied for the long space of twenty-six years. His intimate acquaintance with the rules of the Institute, his acute legal mind, and his shrewdness made him one of the most valuable of officials.

In 1881 Dr. Mackay was further honoured by being made president of the Institute. During his tenure of that office he did much to extend the membership and interest. In his official capacity he attended meetings in most parts of Scotland, but especially in the Highlands and north. Frequently he was sent as delegate to the N.U.T. Conference, and as a member of deputations to members of Parliament he did much valuable work.

As editor of *The Educational News*, Dr. Mackay has been able to mould in many ways the educational policy of Scotland. Obtaining this position when that journal was financially in rather a "parlous" condition, he managed to place it on a sound financial basis. This was not done without the exercise of much energy and ability on his part.

In 1891 Dr. Mackay was honoured by his old university with the degree of LL.D. In 1897 he was elected a member of the Edinburgh School Board, and during the last three years he has been convener of the Evening Schools Committee. As an educationist of wide experience he was of great use on the Board.

He will be missed by a great number of teachers who looked to him for leading and advice on many of the phases of our educational system. The Educational Institute of Scotland is to-day very much poorer because of his death.

EDUCATION IN THE UNITED STATES.

MR. SADLER'S ELEVENTH BOOK OF SPECIAL REPORTS.

Contents of Book the Eleventh.—A dozen articles and four appendices—all but one, by the way, on religious instruction—is the bill of fare presented by Mr. Sadler in this, his eleventh, volume of Special Reports and Inquiries. The first eight chapters deal with Secondary, Commercial, and University Education. Chapter IX. is from the pen of Mr. Sadler himself. It is "A Contrast between German and American Ideals in Education." Education in the American Dependencies, The Holiday Course for Cuban Teachers at Harvard, and The Education of the Coloured Race, are the subjects of the three concluding chapters. The volume contains some 620 pages, and is obtainable from the King's Printers for 2s. 6d.

Curriculum of the American High School.—This, the opening chapter, is from the pen of Mr. D. S. Sanford, Brookline High School, Massachusetts. It contains a full account of the curriculum, together with a comparison between what obtains in Germany and in the United States of America. The following quotation will show how wisely the Americans have dealt with their secondary schools: "No course in natural science was deemed worthy of the name that did not provide for a reasonable amount of experimentation, and require each boy to make in his laboratory notebook an independent record of the results he had obtained;" and so on throughout the whole of the subjects, self-development, as Spencer enjoins, is encouraged to the uttermost. Another point of importance is that the programme is elective—that is, the pupil chooses his own subjects, and is not compelled to take up branches other than those he himself selects. Full particulars of the various curricula are set out in the report.

Secondary Education in a Democratic Community.—This second chapter is by Professor Hanus of Harvard. As the writer is a professor of pedagogy, his remarks are those of the specialist who knows. The whole article is an eloquent, yet withal logical, demand for equality of opportunity, to the intent that the State may reap to the full the advantage that is to be got from the brain of the community. "The most cherished as well as the most comprehensive prerogative of an individual in a democratic society is the right of opportunity—the right to make the most of native endowment, and to achieve material prosperity, culture, and social elevation, through persistent industry, no matter how humble his parentage or how narrow his circumstances in early life."....."To guard against the possible monopoly of education by the wealthy and socially superior classes, it makes education *free;* and in order to guard against the blindness of ignorance, it makes education up to a certain point compulsory." It should be added that in America not only primary, but also secondary, and even university, education is free. The whole of this section of the report is of the most inspiring character.

Comparison between English and American High Schools. By Mr. George L. Fox, rector of the Hopkins Grammar School, Newhaven, Conn.—The first point is that noticed above—namely, that the American boy has no fee to pay, and even his books are provided for him free of charge. As with us, bread-winning precludes knowledge-gaining, so that only a small percentage of those who commence are found to complete the secondary course. In addition to the public High Schools there are many private venture schools, as with us, which of course, being private business enterprises, are not free. The American Secondary School is, as a rule, a *day* and not a boarding school; it is also a *mixed* school. Only a few of the scholars go from these schools to the university. To the large proportion of the scholars this school is the top of the educational ladder. More attention is paid to literature than with us; but Latin and Greek receive much less attention than with us, verse-making being unknown. There is no preparation for scholarships such as enslaves the English public schoolmaster. Teachers specialise in the States—that is, a master teaches one or two subjects to several classes, and not all subjects to a single class. And so the chatty comparison proceeds, letting light on American peculiarities at every step. But we cannot further pursue the subject here.

Co-education in English Schools. By the Rev. Cecil Grant, High School, Keswick.—Mr. Grant answers the question as to whether boys and girls should be taught together, and boarded together, in the affirmative, and he goes into the question in detail, meeting each objector on his own ground. His position is exactly that of Jean Paul Richter, who says: "To ensure modesty, I would advise the education of the sexes together; for two boys will preserve twelve girls, or two girls twelve boys, pure amidst course jokes and suggestions merely by that instinctive sense which is the source of natural modesty. But I will guarantee nothing in a school where girls are alone together, and still less where boys are."

Education and Industry. By Mr. H. Thiselton Mark.—This section occupies 125 pages, and is most exhaustive in its treatment of the subject in all its branches. We learn, for example, how general manual and industrial training have become in the States, and particulars are given of the course as it obtains in the University Elementary School, Chicago. The writer then takes us to the Public High Schools, the Manual Training High Schools, and the Commercial High Schools, and gives us an insight into the working of each from the industrial viewpoint. In like manner is considered "Industrial and Commercial Education in American Colleges and Universities," special reference being made to the "Morrice Act" of 1862, which aimed—and that successfully—at encouraging agricultural and mechanical education. As types of the various scientific, technical, and engineering colleges of America, particulars are given of the Prath Institute, Brooklyn; the Armour Institute, Chicago; the Bradley Polytechnic Institute, Peoria; and the Massachusetts Institute of Technology.

Does a College Education Pay?—With characteristic canniness, the American business man has sized up the value of a college education from the business standpoint, and it will interest English unbelievers in education to know that the verdict is entirely in favour of the collegian. Here are the remarks of one who has summed up the question after mature deliberation: "A new spirit is characterising college officials. They are appearing more and more in the rôle of business men. The new president of old hyper-conservative Yale studies railroads, comes to stand as an international authority on those broad and strenuous business questions, and goes to his high office from the chair of economics." And so with respect to many other instances, all tending to show that scholars are not of necessity "as children" in business matters, as Cecil Rhodes said they were; but—and the proviso is an important one—the business capacity comes from the foundation of special schools and colleges where business and business matters are studied.

The next section treats of Trade Schools, several of which are described; following which comes a brief reference to Truant and Reform Schools, considered, of course, from the industrial standpoint. Then comes a short summary of impressions under the following heads: The outlook towards life; civic and manual training; continuous hand-training in the schools; moral value of manual work; teacher and pupil; the sociological *motif*—each of which is sufficiently important to deserve a PRACTICAL TEACHER article for itself; but we deal but with the surface of things in this fugitive sketch, and so must pass on.

Commercial Education in the States. By Mr. P. J. Hartog, Victoria University.—This, again, is a very seductive chapter, dealing with the five classes of institutions providing commercial education in the United States of America. These are—(1) Commercial or Business Colleges; (2) Public High Schools; (3) Private High Schools and Academies; (4) Public and Private Normal Schools; (5) Universities and Colleges. General statistics are given, showing the relative numerical importance and recent growth of each of these five classes of institutions, and the movement now in exist-

ence in favour of commercial education in the States is also enlarged upon. It is obvious that we can do no more than merely refer to these interesting institutions, for particulars of which the reader must consult the Report itself. We merely mention Mr. Percy Ashley's chapter on American Universities; and of the "Tables showing the Chief Recent Benefactions to Higher Education in the United States," we can only say that it shows American millionaires in their best light, and is a set off against the trusts of which we have been lately hearing so much. The total amount given to higher educational institutions, irrespective of gifts made to libraries and museums, during the last decade is close upon twenty-three million pounds sterling!

A Contrast between German and American Ideals in Education.—This paper, from the pen of Mr. Sadler, now one of the best authorities in the world on systems of education, is a fine piece of writing, worthy of being read and re-read. Here are the opening words of the comparison:—"In Germany, the masses of the people have very little to do with determining the course of educational policy; in America, nearly all education rests on popular control. In Germany, educational progress is guided by administrative order; in America, it depends much more on free discussion. In Germany, as a rule, the keys of the position are in the hands of a strong central authority; in America there is very great local freedom. German society is organised on a military basis; American society on an industrial. In Germany, society is still largely organised in horizontal strata; in America, there is a much more vertical organisation, and a much more open draught from the bottom to the top. Germany (and Prussia in particular) has a strong tradition in favour of direct State management of industrial and other concerns; in America (with considerable exceptions) the tradition is the other way. Germany has long possessed a highly expert, permanent civil service; with certain exceptions, American energy and ability have, until comparatively recent years, flowed in other channels. In Germany, the great majority of teachers are men; in America, the great majority of teachers are women." Not the least interesting part of this engrossing chapter is the account given by Professor Hugo Münsterberg—quoted from *The Atlantic Monthly*—of his own school days at Danzig, in support of his contention that the German habit of looking upon love of learning rather than preparation for business as the aim to be pursued in education is the true ideal. We advise our readers to study this little sermon on Ideals that Mr. Sadler has provided for their delectation. We promise them much enjoyment.

Education in the American Dependencies. By Miss Tanner.—The American dependencies, as all the world knows, are Cuba, Porto Rico, and the Philippines. Miss Tanner gives a very lucid account of what is being done to bring these colonies in line with the United States of America with respect to education, giving as appendices—(1) Regulations for the Public Schools of Cuba; (2) The School Laws of the Island of Porto Rico; and (3) The Act of Congress establishing Public Instruction in the Philippines.

With respect to the Holiday Course for Cuban Teachers at Harvard, the pleasant note throughout is the evident desire of everybody connected with Harvard to make the Cubans as comfortable as possible, and to give them the maximum of help. We referred to this visit in our article on Volume X. of the Reports.

The Education of the Coloured Race. By M. E. Sadler.—In this chapter Mr. Sadler manages to give his readers some very entertaining accounts of the attempts made in the early sixteen hundreds to educate the Indians of Virginia and elsewhere. In dealing with later developments, the hopeful note of the Director's sketch is good to read; for an educated coloured population will be much more amenable to civilisation, and much more likely to command the respect of the whites, than is the case now.

Of Mr. Eliot's article on the Function of Education in Democratic Society, which was delivered before the Brooklyn Institute on October 2, 1897, and which has been reprinted from *The Outlook*, we can only say that it is of the cheeriest description, and it would be good for the democracy no less than for the State at large if only the democrat would regard it as his duty to put his child—so far as he is able—in the way of getting the education that Mr. Eliot rightly regards as his due. Unfortunately the democrat often blocks the way.

The Bible in Schools.—Only a fanatic would rob the children of the noblest book in the English language, and we find that this is practically the verdict of the school superintendents and managers throughout the States; howbeit it is an expurgated Bible, or rather a book of readings from the Bible, that finds most favour in the schools of Americans, and we believe that they are right in their resolve to put the Bible in its best light before school children.

Conclusion.—As is usual with us, we close our volume of Special Reports with the promise of many a pleasant and profitable half-hour to be spent hereafter in "chewing the cud of sweet and bitter fancy," according as we hap upon the few strong and the many weak points of our English system of education.

A SEVENTEENTH CENTURY PEDAGOGUE.

BY HAROLD ARMITAGE.

THE antiquary has not yet been attracted from the world of monasticism, ecclesiology, law, and Gothic architecture to rummage amongst the cartularies of popular education. It is true that the movement for the education of the people of England has a past, but men and women not yet grown old can remember most of it "with little joy," and wish sometimes perhaps, in the interests of our national credit, that it might speedily be forgotten. It is not an inspiring tale, and haply Jonathan Oldbuck would have found its annals, written in a great measure in noughts and crosses on blue foolscap, rather less thrilling than the chronicles of abbeys and law courts inscribed on sheepskins.

Moreover, is not the reformer, even to-day, striving to wrest from the obscurantist the meagre concession of a few first principles? And yet, though popular education is thus a thing of yesterday, there is matter for antiquarianism in other manifestations of the educational spirit, and an example has recently appeared amongst those heel-taps of bibliography that have drifted to the shabby stalls of Farringdon Street.

This piece of educational flotsam is a volume in which the author, one R. Ainsworth, seeks to set forth "The most Natural and Easie Way of INSTITUTION: containing, PROPOSALS for making a DOMESTIC EDUCATION less chargeable to Parents, and More Easie and Beneficial to *Children*. By which Method, Youth may not only make a very considerable Progress in Languages, but also in *Arts* and *Sciences*, in Two Years." The book was printed in London, for Christopher Hussey, "at the Flower-de-Luce in Little-Britain," in 1698.

The author, a "good easy man," had, as we shall see, some ideas that are considered to be quite recent, but he entertained a too complacent view of the state of his own country when he wrote: "The Advantages of giving Children an *Ingenuous* and *Liberal Education*, are so well known in *England* to all *ranks* and *degrees* of Men, we need no *Lacedæmonian Edict*, by which those *Parents* were depriv'd of the Freedom of their City, who were negligent in this Particular, being look'd upon fit for nothing but to cleanse Shoars, and carry Burdens, who condemn'd their *Sons* never to be fit for any better Employment."

Many people interested in education, however, who see in that statement a view all too rosy, will agree with the author when he speaks a word for arts and sciences, and common sense, as against undue claims concerning the importance of Latin and Greek. Many a latter-day teacher, too, will read with a fellow-feeling his admonition of parents: "Who don't ordinarily take care to have their Children taught to read, till they are so habituated to *Vice* and *Idleness*, that their Teacher must have as much Labour to bring 'em into love with their Book, as otherwise would have taught 'em to read; from whence also various Inconveniences arise both to the *Parents* and *Children*."

Dames' schools have survived into our own time; but this early writer on pedagogics was not unconscious, even then, of their manifold shortcomings, for in continuing his strictures on negligent parents, he has written:—"If they do take care to send 'em to *School*, perhaps 'tis to some *Woman* who never knew any thing of *Orthography*, tho' she may make a shift to read her *Prayers*, or Murder a *Gazette*, confounding one Period with another, which she must needs do, having never been acquainted with the *Rules* of *Pointing*. Hence it comes to pass, that *Vulgar People*, who only have learn'd to *Read* and *Write* at this rate, commit such horrible blunders in *Spelling*, and making no *Points*, are at the hazard of having no one, that writes *true*, to understand what they mean."

He urges that a teacher should be a good man as well as a good scholar:—"He ought to be a *Vertuous*, *Modest*, and *humble Man*, and very patient; his chief business ought to be to dissipate, by soft and gentle means, those *passions* that would *over-cast* the early *dawnings* of infant *Reason*, that it may shine out *bright* and *glorious;* and with a gentle hand, to weed out the *Tares* which perhaps were sown when the Parents slept, before they are grown so high, as to Choak the *Culture* of an *Ingenuous* and *Liberal Education*, to cherish the *Principles* of *Kindness*, and *good Nature*, till they are grown into HABITS; to settle a *Reverence* to their *Parents* and *Masters*, and a *Love* and *Respect* for *all*, and they will soon enough afterwards learn to exert them in a *fashionable Mein*, and *decent Comportment*, which, when they have learn'd with a *Dancing-master*, will more admirably become them, when their *Bows* and *Honours*, not forc'd by *Modes* and *Fashions*, not *Ap'd* and *Mimick'd*, but found to be real by the Divine sweetness of their Looks, which no Art can teach, will not only challenge from all Persons an high Commendation of their Parts and Breeding, but also gain 'em every where an *Admiration* and *Love* for their *Virtue*."

Parents who grudge to spend money on the education of their children he writes of with much contempt, and adds that "when he has a considerable stock of Money by him, is he not apt to be uneasie, till he has put it out to *Interest*, hearken'd out a *Mortgage*, or wisely transmuted it into good *Terra firma;* because, says he, let *Fires*, *losses at Sea*, *change of Government*, any, or all of these happen, this will stay upon the spot, I shall still have this to leave my Son. Yet tho' the Land, as he saith, will still abide on the spot, he knows how moveable a skin or two of Parchment is. One would think now, if he could light of a Purchase more secure, and more advantageous too, for his Son, he should not grudge to lay out his Money upon it. If he ask me what that is, I answer: A *Vertuous* and *Learned Education;* and that too, (if he be as careful as he generally is) he may have a very good Penny-worth. Only let him remember, *The best is the best Cheap*."

In the matter of physical education he points to the Romans, and to others who "were far enough from bringing up their *Children* with that *softness*, and *niceness*, as our Cocker'd Citizens are;" and he has some words of admonition for "those *Irregularities* in his *Meat*, *Play*, or *Sleep*, which the ill-tim'd and pernicious *Indulgence* of many *Parents* often winks at, and oftner sees not." Another evil which our author refers to is one which modern teachers have had to combat: "The next Charge I have against *Parents*, is their frequent *removing* their Sons from one School to another, upon the slightest Reasons, and sometimes none at all: then which, nothing is more apt to rebate the Masters diligence, who cannot tell but another may reap the fruit, and have the credit of his care and pains."

The senseless "learning by heart," once such a favourite school method, had an early opponent in the author of this interesting volume, who puts in a mild claim for understanding "not by rote, but reason," and for being "more cunning in understanding the thing than rehearsing the words":—"In my Judgment, those *Masters* who take a different *method* to their Prescriptions, (except as before Excepted) walk a tedious round; but especially such as teach all the *Rules* and *Exceptions* as they follow one another before their *Pupil* reads an *Author*. For if *Children* should by the *Master's* diligence, and continual beating their brains about the fence of this, or that particular *Rule*, or *Exception*, be brought to some little Notions about them, 'tis ten to one, but being forc'd to summon all their thoughts to understand the next, the *Ideas* they had conceived about the former are quite *obliterated;* by this means it often comes to pass that one poor *Exception*, which perhaps might not occur above once in an *Author*, at last is understood at the loss of two or three *General Rules*, and some *Leather* in at the bargain."

He is all for kindliness in education, and has written that "the *harshness* and *severity* of others, is a great obstacle to Children's *Improvement*. Were they to perform their hard *task*, and carry *burdens* like *Slaves*, and not for every little *Omission*, or *Peccadillo*, to be thump'd like them, I should think their condition something different."

But it should not be forgotten that this writer, who in other parts of his book takes a side upon the corporal punishment question which is not in accordance with the views of teachers to-day, also advocates that "the number of Pupils exceed not Twelve"—a number that would be quite lost amongst those mass meetings which some School Boards and Managers of Voluntary Schools understand as classes to-day.

Our author's ideal school, it will interest Metropolitan teachers to know, "ought not to be propos'd in *London*, because the *Air* is not so good." The ideal school should have a garden, that the flowers may serve for many kinds of object lessons. "From their very *Names* they may learn a good part of the Heathen *Mythology*, as of *Daphne*, *Narcissus*, *Hyacinthus*, &c." The inquisitiveness of children should be utilised, "for their whole instruction ought to be as it were occasional, and not designed."

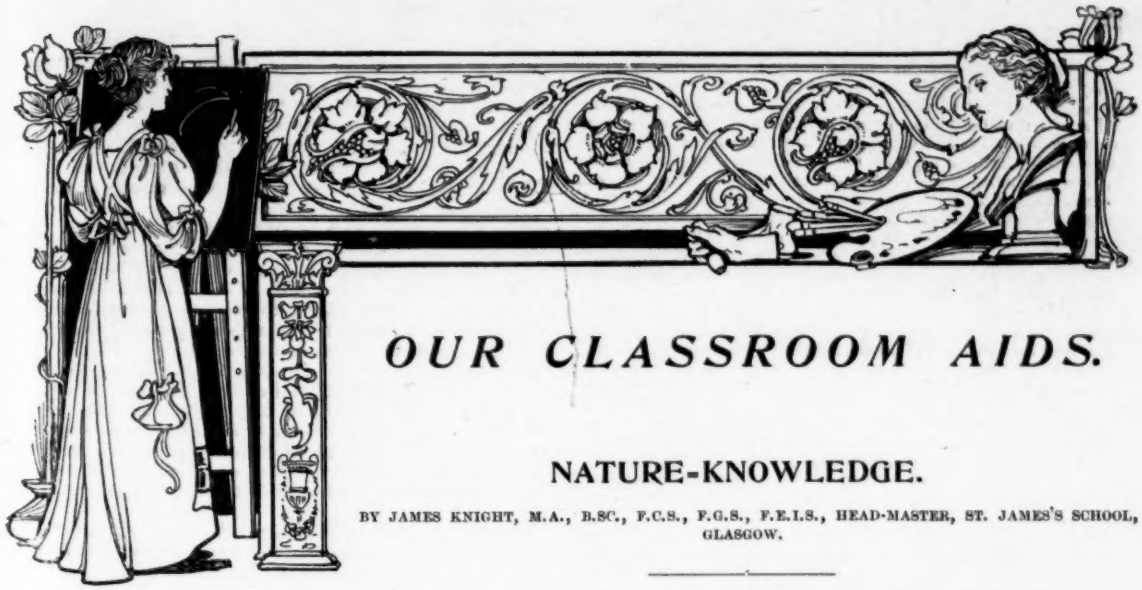
"If any one ask how Latin is to be made a *living Language*, I answer: Their Master, who is always to be present as before, shall (after three Months spent in learning so much *Grammar* as may be necessary for them) never speak any other Language to them, nor suffer any other to be spoke before them. The Mistress of the House, in some measure, should understand and speak Latin, at least such forms as will suit her Occasions, which are about *Dressing* and *Undressing*, and serving them with *Meat;* and no Servant, at any time, be suffer'd to speak to any of them but before the Master, and that in a *prescrib'd form*.

"But tho' I were assur'd my Son may learn Latin the same way he learn'd English, by *Conversation*, in two Years time or less, yet you mean, he shall only then speak Latin as he now speaks English—*i.e.*, Improperly. If he now speaks English *improperly*, there is a *proper* Reason to be assign'd for it; because he has convers'd most with those that spoke *improperly*, his Nurse or Servants.....

"These pretty little *Mimics*, with a sweet and natural delight, listen to all our sounds, and very well understand them in a few Months, so far (at least) as they any way concern themselves, as may be observ'd by many of their *Actions*, and desire to be understood themselves. Nay, they are so concern'd their little *Mimicisms* cannot be conceiv'd, that they make a thousand signs to shew their meaning, which is as pleasant, and delightful a *Rhetoric*, to such as have but the *Leisure*, and Curiosity to observe them, as the quaintest *Diction*, and most celebrated *Harangue*. Children have, by Nature, no greater *Aptness* to imitate one Tongue than another; the Children of *Jews*, *Arabians*, *French* and *English*, come to speak much at the same time, and need not any particular *Rules* and *Directions* about the Matter, nor indeed ever understand they are Learning, and yet they all arrive at a tolerable Proficiency in two Years. The consequence is therefore, they would equally understand *Latin* in that time."

About a dozen years ago the Gouin method of teaching languages was introduced into this country, and it was hailed by many as a new method. Yet here was the Gouin method—that is, Nature's own method—advocated long before Gouin was born.

However, we must now take leave of our author, and in doing so we will commend to the busy writers of our own time his closing lines, significant surely of a more leisurely age than the one in which we live:—"Such as desire to discourse the Author upon these Proposals, may hear of him at the Booksellers, or at the *Marine* Coffee-House in *Birchin-Lane*, after Change, who can inform them of Undertakers."



OUR CLASSROOM AIDS.

NATURE-KNOWLEDGE.

BY JAMES KNIGHT, M.A., B.SC., F.C.S., F.G.S., F.E.I.S., HEAD-MASTER, ST. JAMES'S SCHOOL, GLASGOW.

PARTS OF A FLOWER.

THE notes in this lesson are intended as a reserve fund of information likely to be used when dissecting or describing a flower.

We have already seen that a typical flower contains at least four whorls of floral leaves, as shown in this scheme:—

Floral leaves ... { Protective (Perianth). { Calyx = sepals. / Corolla = petals. / Reproductive ..... { Stamens (*m.*). / Carpels (*f.*).

We begin with the outermost whorl, the sepals, which collectively form the calyx or cup (Ger. *kelch*), denoted in botanical shorthand by K. The calyx is early formed, before the flower proper, and is therefore generally green and leaf-like, with wide sepals which form a closed cup over the developing organs within. In the bud stage the sepals only are visible; even when the flower opens the sepals often close up again at night, so as to shield the more delicate parts from frost. The other enemy of a flower of this kind is insects of the ant type, which are regarded as "undesirables," since they steal the honey without paying the usual price—fertilisation. The sepals are therefore generally made sturdy to resist the bites of such visitors, and they are often provided with hairs placed so as to repel any advance of an insect creeping up the stem, while, of course, offering no obstacle to the visit of an insect on the wing. Further, when the flower opens and displays its attractions of colour, scent, and taste, the calyx sepals are often turned back on the stem, the more effectually to ward off ants and their like. Very often, as in the poppy, they fall off altogether when the corolla opens, their work being done.

The different varieties of fuchsia are good examples of a calyx taking upon itself much of the advertising which usually falls to the corolla. In the common wild fuchsia the corolla is purple and small, therefore not easily seen; but the calyx assumes a bright crimson tint, and spreads its sepals wide, so as to present a brave show. Any fruiterer will supply the Cape gooseberry, the bright red sepals of which serve the same end. Lastly, the calyx often helps to disperse the seeds, as in the parachute calyx of dandelion and similar plants.

The corolla leaves are usually the most delicate structures of a plant. They are bright coloured, often streaked or marked by leading lines, which serve as guides to insect visitors in search of honey. This honey or nectar is sure to be found in little glands called nectaries, so placed that in attempting to reach them an insect must brush against the generative organs, and so help to fertilise the flower. The petals, which may be separate or united, are often clawed or fringed, as in the pinks, an arrangement which seems to lend additional attractiveness. Since the petals are delicate, they can give protection only to a small extent; but many instances will occur (for example, crocus) where they close up, not only on the approach of rain or night, but even when the sun is obscured for a while.

The great function of the corolla is to attract insects, offering them honey for nothing in return for their good offices. Very often the petals serve merely as a landing-stage for these winged friends, which then find their way into the interior of the flower. In such flowers as horse-chestnut and rhododendron, where the petals are not available for this purpose, the stamens are extra long and sturdy, and are used by bees and other big insects as a stage. In composite flowers of the daisy type there are two kinds of petals—an inner tubular set containing the generative organs, and an outer strap-shaped set, which are quite barren. These last serve only for attracting insects, and then providing them with standing room. In the chrysanthemum even the outer flowers are also barren, and serve the same ends.

Note here that small inconspicuous flowers make up for their individual smallness by grouping themselves into heads, and very often in a head of flowers (hydrangea) the outer flowers are broad but barren, serving for attraction and support, while the central fertile flowers are much smaller.

Note also that scent and colour are usually complementary, bright-coloured flowers being not so strongly scented. Flowers which are fertilised by moths and other evening insects are generally white, the colour most easily seen in a bad light; and they are strongly scented as well. In many cases the scent only appears towards evening, otherwise it might attract earlier and less suitable visitors. The letter C is the symbol for corolla.

The stamens present few features. They are best studied in such large flowers as orange and tiger lilies, rhododendrons, azaleas, etc., and they may easily be divided into pollen-cases or anthers and supporting threads or filaments. The latter are not necessary, and in orchids the anthers sit upon the corolla without further support. Generally the stamens are in number a simple multiple of the petals: very often there are 5 petals, say, and 5, 10, or 15 stamens. In such cases observe the order in which the stamens come, so as to get a correct floral diagram. The outer row usually alternate with the petals, standing opposite the sepals; the second row are opposite the petals; a third row follows the first, and so on. Wallflower presents a curious case, with its two long stamens and four short ones; its floral diagram was given last month. Very often one or more stamens have disappeared: thus the speedwell (*Veronica*) has only two left. Oliver's *Systematic Botany* (Blackie) will be found useful as a guide over these difficult and exceptional forms. The behaviour of the stamens in fertilisation will be treated later on in discussing pollination; all that is wanted at this stage is to examine the pollen-cases of such a flower as a rhododendron or tiger lily, and rub off some of the pollen to see what it is like. The botanical sign for stamens is A (*androecium*), and the anthers form the male part of the flower.

The female portion is represented by the carpels, leaves which are folded together so as to form the pistil. The botanical symbol for these is G (*gynæcium*). The pistil of such a flower as a lily shows a sticky head or knob called the stigma, which serves to catch and retain pollen grains; a stalk or tube, called the style, not always present; lastly, the ovary or egg chamber, in which lie the ovules awaiting fertilisation to grow into seeds. Roughly speaking, a seed is a fertilised ovule, and a fruit is a fertilised pistil, for the whole female part of the flower generally shares in the changes due to fertilisation, as will be seen later on.

Two points here call for notice. First, in double flowers beauty has been gained at the expense of fertility. Take a wild rose and compare it with a garden rose, a single with a double dahlia, a single and double azalea, etc. It will be evident that the single flower has few petals and many stamens; whereas the double flower has many petals, but very few stamens or none at all, thus becoming barren. A water-lily shows best of all the gradual passage of green leaf, as in the sepals, first into white petals, then into petaloid stamens, and finally into stamens, thus confirming the thesis that all the parts of a flower are modified leaves. Since double flowers are mostly barren, they cannot be raised from seed, but must be propagated by slips, runners, or cuttings, or by dividing the roots.

The other point is the distribution of sex on a plant. Many flowers have both male and female organs, but the male organs ripen first, and are thus of no use for their own females, though they may fertilise the pistils of some earlier flower of their own sort. In many cases self-fertilisation is avoided by the arrangement of stamens and pistils. Thus in drooping flowers where the stamens ripen first, they project beyond the pistil, so that their pollen cannot possibly fall on their own pistil; then, when their work is done, they shrivel up or bend back, and allow the pistil to project, so as to get a better chance of receiving pollen. For these consult the chapters on "Marriage Customs" in Grant Allen's *Story of the Plants*.

Almost any forest tree will illustrate those plants which separate the sexes, male flowers being confined to one tree, females to another, and no better tree can be got for this than the common willow. This and the dog's mercury (*Euphorbium*) are all the more welcome that they are spring flowers, occurring at the very time when materials for these lessons are not overplentiful. Note in connection with the willow that the flowers appear before the leaves, and that the same arrangement holds good with all those trees which are fertilised by wind rather than by insects—for example, elm, birch, alder, poplar, beech, oak. It is obvious that, with the very small flowers which these trees possess, the growth of dense foliage would seriously interfere with the dispersion of pollen.

HISTORY DAY BY DAY.

ON the anniversary of any great event, many teachers improve the occasion by having a few minutes' talk with their classes on that subject. This is an excellent practice, and one that we think would be still more widely followed were it not for the large amount of work entailed in ascertaining the precise dates of historical events. We therefore propose to give each month a list of the principal events for that month, with a few particulars concerning them; and we venture to think that those teachers who spend a few minutes every day over that day's event will find themselves amply repaid in the increased knowledge of history shown by the children, in the widening of their views, and in the deepening of their interest in the subject.

January.

1st. *Union with Ireland, 1801.*—In consequence of the Irish rebellion, and also of the difference of opinion between the two Parliaments respecting the regency of the Prince of Wales during the illness of George the Third, Pitt proposed the union of the Parliaments in June 1800. By means of extensive bribery and a lavish distribution of peerages the Bill passed, and the union dated from January 1, 1801.

2nd. *Recapture of Calcutta, 1757.*—Calcutta was originally a small trading settlement founded in the reign of William the Third, and known as Fort William. In 1756 Surajah Dowlah, at the instigation of the French, seized Fort William, and confined 146 persons in the terrible dungeon known as the Black Hole of Calcutta. Clive hastened to avenge this outrage, and recaptured Calcutta on January 2, 1757.

3rd. This and the two succeeding days witnessed the events which brought matters to a climax between Charles the First and the Parliament, and plunged the country into civil war. Charles sent a herald-at-arms to the House of Commons to arrest Hampden, Pym, Hollis, Strode, and Haselrig on the charge of high treason in their communications with the Scots. The Commons refused to give them up, but promised to consider the demand.

4th. Enraged at this resistance to his commands, Charles himself went down to the House, accompanied by a number of cavaliers, to make himself "master of his kingdom." The news of his approach having reached the Commons, the five members were ordered to withdraw. "I see," said Charles, surveying the empty places, "the birds have flown; but I do expect that you will send them to me as soon as they do return."

5th. The five members having taken refuge in the city, writs were issued for their arrest, and Charles himself demanded their surrender from the aldermen at the Guildhall.

6th. *Declaration of War with China, 1841.*—The Chinese Government had taken steps to suppress the opium trade; but as some of these interfered with the property and rights of English traders, war was declared.

7th. *Calais lost, 1558.*—In spite of the pledges given at her marriage, Mary dragged England into war to support her husband Philip of Spain in his struggle with France. The Duke of Guise suddenly attacked Calais, and compelled it to surrender. Although the loss of Calais was deeply felt by the nation, so strong was the feeling against Mary that the council refused to find either arms or money for its recapture.

8th. *The English, under General Packenham, attacked New Orleans*, but were repulsed by the Americans under General Jackson (1814). This is a striking illustration of the slow way in which even important dispatches were sent in those days compared with the present time, for peace had been signed between England and America in the previous December.

9th. *Nelson's Funeral, 1806.*—After Nelson's death in the Battle of Trafalgar, the body was brought to England on the *Victory*, and after lying in state in Greenwich Hospital it was interred in St. Paul's Cathedral, being honoured with a magnificent public funeral.

10th. *Penny Post inaugurated, 1840.*—This comprehensive reform was brought about by the untiring efforts of Mr. (afterwards Sir) Rowland Hill.

Laud executed, 1645.—Laud strove hard to make the Anglican Church an independent branch of the Roman Catholic Church, hoping for a reunion with Rome by meeting her half-way. He persecuted the Puritans with great severity through the Court of High Commission.

11th. *Rebellion in Canada, 1838.*—Canada was at this time divided into two provinces, Upper and Lower Canada. The inhabitants of the former were mostly British colonists, whilst the latter was peopled by the descendants of the original French settlers. Great jealousy prevailed between these two sections, which finally resulted in an outbreak of the French settlers. The rebellion was soon quelled, and Lord Durham was sent out to inquire into the grievances of the French.

12th. *Zulu War commenced, 1879.*—A dispute having arisen between the Boers and Zulus respecting a strip of territory, the question was referred to England for arbitration. The arbitrators decided in favour of the Zulus; but when Sir Bartle Frere, the High Commissioner, communicated the decision to Cetewayo, he accompanied it (on his own responsibility) with the ultimatum that the Zulu army must be immediately disbanded. This was practically a declaration of war.

13th. *The Coronation of Elizabeth, 1558.*—"Never had the fortunes of England sunk to a lower ebb than at the moment when Elizabeth mounted the throne. The country was humiliated by defeat, and brought to the verge of rebellion by the bloodshed and misgovernment of Mary's reign. The death of Mary alone averted a general revolt, and a burst of enthusiastic joy hailed the accession of Elizabeth."

14th. *Death of Duke of Clarence*, the eldest son of King Edward the Seventh.

15th. *The Discovery of the Sandwich Isles.*—This group of islands was discovered by Captain Cook in 1778, and here he met his death in the following year.

16th. *Corunna, 1809.*—Two small armies were sent to the Peninsula to assist the Spaniards against Napoleon. One, under Sir John Moore, advanced from Lisbon to Salamanca; but on arriving there he found the Spanish forces com-

pletely crushed, and was obliged to beat a hasty retreat to the coast. He was followed up by the French, and a fierce battle took place at Corunna, when the English beat off their pursuers, and were thus enabled to embark in safety. Sir John Moore was killed during the action.

17th. *Coomassie occupied, 1896.*—Prempeh, the young king of the Ashantees, having been found promoting the slave trade, attacking friendly tribes, and obstructing commerce in many ways, an expedition was dispatched under Sir Francis Scott. Coomassie was occupied by the British, and Prempeh taken prisoner.

18th. *German Empire proclaimed, 1871.*—Napoleon the Third had declared war against Prussia to recover his military popularity. The French were, however, totally unprepared, and lost battle after battle. Napoleon surrendered at Sedan, and France became a republic. Whilst the Prussian troops lay around Paris, William was proclaimed Emperor of Germany at Versailles.

19th. *Ciudad Rodrigo captured by Wellington, 1812.*—This important frontier fortress was taken by the French in 1810. When Wellington took up his position in the lines of Torres Vedras, Massena was forced to fall back on Ciudad Rodrigo. In 1812, Wellington, having been reinforced, was able to abandon his lines and assume the offensive, and he promptly attacked the town and took it by storm.

20th. *Hong-Kong ceded, 1841.*—In consequence of the attitude adopted by England on 6th January, the Chinese minister ceded Hong-Kong, and promised to pay 6,000,000 dollars. On 20th January the city was occupied by the British, and has remained in our possession ever since. Subsequently, this treaty was rejected by the emperor, and hostilities commenced.

21st. *Execution of Louis the Sixteenth, 1793.*—In October 1789 the mob had marched to Versailles and forced the king to return with them to Paris. The following July the Bastille was stormed by the mob, and Louis became a prisoner. In June 1791 he attempted to escape, but was captured and more rigorously guarded. Germany now threatened war on behalf of the king; but the expedition having failed, Louis was brought to the guillotine.

22nd. *Isandula and Rorke's Drift, 1879.*—So rapidly had events taken place in Zululand that the first news to reach England was that disaster had befallen the British forces. The camp at Isandula was attacked by about 15,000 Zulus and completely annihilated. On the same day Rorke's Drift, about ten miles away, was attacked; but a most heroic defence was made by the handful of men under Lieutenants Chard and Bromhead.

23rd. *Death of Pitt, 1806.*—"Austerlitz," wrote Wilberforce, "killed Pitt." Though only forty-seven years of age, the anxiety of guiding England through these troubled times had proved too much for his delicate constitution, and the news of Napoleon's victory shattered alike his hopes and his strength. "Roll up that map," he said, pointing to a map of Europe; "it will not be wanted for these ten years." Even to the end his thoughts were for his country, his last words being, "My country! How I leave my country!"

24th. *Fox born, 1749.*—Charles James Fox was the great rival of Pitt. When the American War of Independence broke out, he joined with Burke in opposing it. On the death of Rockingham, Fox formed with Lord North a coalition ministry. Though hardly the equal of Pitt and Burke in eloquence, Fox was an able speaker and debater, and had a manly, telling style of delivery.

25th. *Constitutions of Clarendon, 1164.*—Enacted at a council held at Clarendon to retrench the power of the clergy. The most important clause decided that suits involving the clergy should be tried in the King's Courts and not in the Church Courts, and also that no one should appeal to the Papal Court without the king's consent.

26th. *Death of General Gordon, 1885.*—During the revolt of the Mahdi, Gordon had gone on a peaceful mission to Khartoum, of which he had formerly been the governor. He was attacked and besieged by the Mahdi. No relief was sent from this country till August 1884, but before it arrived Khartoum had fallen.

27th. *Trial of Charles the First, 1649.*—This trial, which had lasted five days, was concluded, and Charles was condemned to death as a tyrant, traitor, murderer, and enemy of his country.

28th. *Paris capitulated, 1871.*—This brought the Franco-Prussian War to a close. France had to pay £200,000,000 indemnity, and cede the provinces of Alsace and Lorraine.

29th. *Luddite Riots, 1811.*—A serious skirmish took place at Nottingham between the military and large parties of men who, believing the prevailing distress to be due to the introduction of machinery, committed great havoc by destroying machines wherever they could.

30th. *Execution of Charles the First, 1649.*

31st. *Battle of Amoaful, 1874.*—The Ashantee king having attacked our allies, Sir Garnet Wolseley was dispatched on a punitive expedition, and inflicted a severe defeat on them at Amoaful.

NATURE STUDY FOR THE MONTH.

BY J. O. BORLEY, M.A.

THE object of the present series of notes is to provide materials for lessons and observations on commonly occurring natural objects and processes, which shall be fairly appropriate to the month in which the notes are issued. The word fairly is used advisedly, as there are obviously many subjects—a flint stone, for example, or the properties of air—which it would be unwise to neglect, and which can be dealt with as well at one time as at another. The notes are intended for use in elementary schools; they are, therefore, unavoidably simple—a fact which must stand as their excuse for repeating many things neither new nor strange. No attempt will be made to indicate the quantity of work for each lesson, nor what of detail and completeness to omit with lower classes; these things are essentially the teacher's to control.

It will be as well to state briefly the chief ends to which the work is directed before commencing it. Although capable of immensely varied treatment, nature lessons are bound to be in the main akin to object lessons, and are, therefore, open to all the possibilities these possess, and to all the faults into which they may decline.

To say that they are intended to develop the powers of observation, besides imparting knowledge, is, of course, true, but is so general as to need definition.

First, the power of observation is to be brought into existence. A few questions about the commonest daily surroundings of children reveal in how surprisingly many of them it is almost absent. Secondly, it is to be aided into trustworthiness. Young students are wonderfully diffident of their own results; they are only too willing to accept statements as to what an experiment should have shown—but did not. And once divorced from observation, nature knowledge ceases. It is really instructive to repeat, a good time after its first performance, some simple experiment (say the burning of phosphorus under a bell-jar), and ask the class what can be learnt from it alone. The amount of knowledge derived from other and subsequent work that is read into the inference, almost always including the names and exact proportions of the gases involved, is surprising. The best diagnosis seems to be that this is a case of over-emphasis of the conclusion arrived at, and proportionate neglect of its connection with experiment—a view supported by the frequency with which students who have just been through a course of object lessons or science meet a new experiment with, "What is this to prove?"

To the mind in this stage the experiment is a flimsy pretence of justification for a statement really accepted already. Human indolence pleads strongly in most of us for such an attitude. The best ways to guard against it seem to be the insistence on the observation being complete before any conclusion is discussed, invincible candour in the record of results, and equally open statements about things beyond the reach of class experiments where these are to be dealt with. Many prefer to eliminate the latter altogether; something about the retention of such topics is said later.

How can the power of observation be aided in its first stages? It is worth pointing out that practical work of any sort has more advantages over the witnessing of such work by another than mere nearness of view. Sustained attention is one. Another very great one is the employment of the sense of touch, which is in some ways the most real of senses; sight is more used. Taste is at least as intimate, perhaps so intimate as to give us predominately the idea of a flavour within us, rather than an object without. Probably this is truer still of children; and so, while it may be heroic to endeavour to improve the other senses, it is more convenient to use at first that giving plainest effects. Another advantage of practical work is that it comes near to individual tuition. To each his difficulties or successes are personal; to each it is less possible to rely on others' efforts. Moreover a difficulty is immediately a mute question to the teacher. Some apology is perhaps needed for restating these generalities: it can take the form of a hearty assurance to the many who labour with little or no tools to introduce some measure of personal work into object lessons, that that labour is of the most fruitful kind.

A last word as to the trustworthiness of personal observation. A person who trusts his impressions lives in a real not a verbal world; he will trust them if they are clear to himself and justified by future knowledge. It seems, therefore, that they must have two aspects—two bridges: one from the past of ordinary experience, one onward. To choose for nature lessons things fit for the time may aid the maintenance of the former. This keeping in touch with everyday things, and, perhaps, registration of such natural events as rain and wind, form the defence of such lessons from the serious charge of want of continuity.

On the second aspect of the sense of trustworthiness there is much more difference of opinion, for this aspect consists in taking the inquiries sufficiently deep to link the lessons to the special sciences some of the older children will study, and prevent the matter of those sciences from being something isolated, unintelligible, apart. Obviously, the whole question is one of degree, and a matter for individual discretion. It is to be remembered that as far as the information gained will be valuable, it will be so by aiding to make real the child's future knowledge, which will include facts about many things with what he may never come into contact. Wherever possible, a permanent note-book should be kept by each child.

Ice.

Items can be summarised as follows:—

Ice
- Melting-point
  - Determination.
  - Is same as freezing-point.
- Takes in heat when melting.
- Influence of pressure on melting-point.
- Influence of solids in solution on melting-point.
- Lightness—effect in forming icebergs.
- Expansion on freezing.

For this and the next subject there are required glass beakers, or tumblers, or jam-pots; a thermometer, preferably a so-called chemical one (that is, without wooden frame, though this is not essential); some ice, water, and a freezing mixture made by mixing ice in small pieces with half its weight of salt.

The melting-point can be found by pushing thermometer among melting ice in a bowl. If water in a tin or test-tube is thrust into the freezing mixture, the contents soon freeze, and a thermometer left in it is found to have the same temperature as melting ice. Hence freezing and melting point are the same. At this temperature, then, ice and water can exist in contact. What determines which shall remain in any one case? Take water cooled to freezing-point by melting ice in it, and partly immerse a tin of it in freezing mixture, which thermometer gives as below freezing-point. It freezes. Serve out perceptibly tepid water and a piece of ice to each pair or trio of children. As the ice put in the water melts, they will find the water chilled. Hence, ice takes in heat in melting; water at 0° which loses heat freezes.

The freezing-point can be changed by pressure or by solids dissolved in the water. To study the former, place a loop of wire through the ring of a weight of 5 lbs. or more, or tie to some heavy article; slip it over a block of ice, and rest the two ends of the ice on two chairs put side by side, and put a pan beneath to catch the water formed as it melts. After a time the wire will be found to have melted its way in, and the water frozen above it. Left alone, the block is thus in the end cut right through without fracture. The water escaping from below the wire froze above it. Hence it was not above freezing-point. The ice under the wire melted, hence it found itself above its freezing-point. The idea that it was at its ordinary freezing-point and receiving heat is negatived by its freezing again above the wire. Therefore ice at its ordinary freezing-point is above its freezing-point under pressure. Pressure lowers the freezing-point of water.

This is an appropriate place to mention regelation—the power of ice to adhere to ice. Floating pieces of ice, put liberally enough in a bowl to jostle one another, and left for a minute or so, often adhere. Count the pieces put in, and by gently lifting see how many have done so. The making of a snowball is another instance of the same thing. There are two explanations offered. One is that the pressure set up by the impact of two pieces, and relieved by the rebound, first melts and then freezes together the pieces. The pressure certainly seems to the average mind somewhat insufficient, in view of the slow descent of the wire in the last experiment; of course, however, a mere film of water formed and then frozen is all that is required. The other explanation is that the film of water, here supposed never to be quite squeezed out from between them, becomes for an instant the middle part of a block formed of the two. This block, by melting and evaporating at its surface, is absorbing heat from all surrounding things above melting-point; the water, accordingly, is chilled by the chilled ice on each side of it, and the latter passes on the heat received to the outside film. The intermediate ice does not melt, nor is the heat-conducting power of ice great. These seem difficulties; but, on the other hand, this explanation gives a reason for the difficulty of forming snowballs from very dry, cold snow. At any rate, the part of regelation is important.

To study the effect of solution, let children dissolve up as much salt as possible in a small tin of water (small mustard tin or test-tube), and in another similar one put a similar amount of water; then thrust both at once into the freezing mixture, and withdraw to examine at the end of each minute till one is frozen. Notice the salt solution still unfrozen. Test-tubes are best to use, as one bowl of ice then holds tubes from many groups. The fact taught, that salt water has lower freezing-point than fresh, is of great importance, in view of its keeping at a minimum the area of the sea frozen.

One of the first things noted about the ice used in class will be that it floats. It is convenient to refer here to the resulting preservation of ponds and streams from complete solidification, and to the subject of icebergs. Snow falling within the Arctic circle has little time for melting. It can by regelation, and under pressure, form compact masses of ice. When sufficiently heavy, these slide slowly down the mountains and the shores into the sea as glaciers. Each mass, being recruited from behind, becomes a stream, or rather huge sliding rod of ice. This rod is compelled by its descent to point down into the sea. Hence its end is forced under water. Let the children force their ice under water, and feel its pressure and sliding motions to get up again. The rod of ice breaks, and a great block floats up as an iceberg.

It is fairly easy to learn that to be lighter than water the ice must have swelled or expanded. A small bottle of water, quite full and well corked, can easily be broken by immersion in the freezing mixture, showing at once the expansion, by the exuded ice and the force with which expansion takes place, by the breakage. The disintegrating effects of frost on rocks and water-pipes are consequences of expansion. In the case of the unfortunate pipes, the chief thing to be emphasised is probably that the thaw does not do the damage to the pipes, though it does to the walls of the house. A noteworthy result of frost disintegration is the regularity of Arctic mountains. The cracks which water enters and forces open on freezing will be

downwards on one side, and between the layers of rock on the other side, which is really made up of the edges of

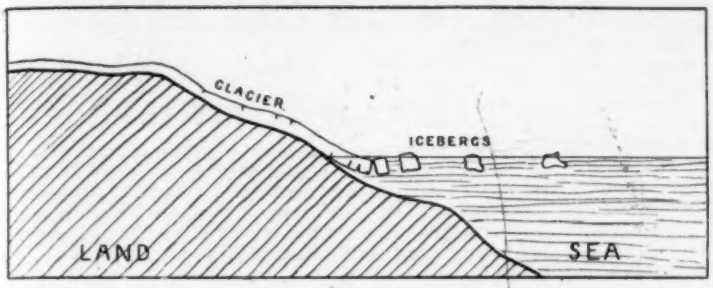


Fig. 1.

the tilted layers. Accordingly, the sides of the mountain break off in regular blocks, leaving each side a flat not

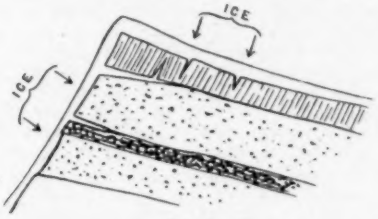


Fig. 2.

a curved slope. Great Gable, in the Lake District, is a case in point.

Snow.

Facts to be treated can be thus summarised :—

Form	Flat crystals. Six pointed rays being at equal angles with each other.
Lightness	Discovery and emphasis. Due to looseness of pack. Effects of this on living things.
Formation	Water is in air. Air when cooled deposits snow.

Accumulation and its results :—

Growth	Solids forming attract each other. Most at points, least at flat surfaces. Medium amount at edges ; hoar-frost.

Snowflakes can be gathered well on a slate, plate, shovel, or other flat object (preferably a dark one), which has been left in the air for a few minutes to cool. A simple lens is very useful in observing their form. The observation must be out of doors, as even on a shovel stood on ice the crystals soon moisten. It will be seen at once whether the snow has many pure crystals. If not, the flakes are generally large, made up of smaller flakes, and moist. As many falls as possible might be examined, and record kept of the cases in which snow was moist, dry, fine, coarse, plainly in crystals. The fact that clusters of crystals are often moist is allied to the snowball question of the ice study.

The points remarkable about the form of snow crystals are (1) their flatness ; (2) their six points ; (3) if these, as is usually the case, are the base of rays, the equality of angle between such rays ; (4) the existence of secondary rays, still at 60° to the primary rays. (4) is difficult to see, as a rule, except with a microscope. A very modest instrument is sufficient, and here, as elsewhere, an enormous boon. Left in the open to get chilled, several children in turn can look through it without the flakes melting.

The children should draw what they think the shape of the crystals, then the above four points be noted. Then a large blackboard diagram should be drawn and discussed, copied from memory on scrap paper, and the memory sketches compared with the original. A few pictures of snow crystals can be shown—there are good ones in Tyndall's *Heat* and in most physiography books. Lastly, where possible the following drawing should be made for preservation. It is typical of the four points ; it is far better drawn by compasses than freehand.

First draw a small circle, mark off the radius round the circumference, and join those points to make a hexagon (Fig. 3). Next, with same centre, draw circles BCD at greater distance. Draw two lines from each point to the outer circle, keeping the ruler through the centre, as in EKNF. These represent primary rays. The points where B and C cut the main rays can be used as starting-points for secondary rays, as MY, which should be drawn parallel to neighbouring primary rays. If they are taken in each case only as far as lines such as LX, which join hexagon points to neighbouring ray points, symmetry is obtained. Line in thickly, and rub out construction lines. The diagram is clumsy but plain, and definitely does its duty of registering facts.

Snow is very light. Hold in one hand a cup or test-tube full of snow, and one of water in the other: better use a small pair of scales, putting one cup in each pan, or tie the two to opposite ends of a ruler, supported in the middle by a loop of string. This lightness is due to looseness of pack, which can be shown by each child letting its test-tube of snow melt, and noticing the little water produced. The air enclosed between the rays is important ; it acts as a non-conductor of heat, a snow sheet resembling a woollen blanket in this respect: the result is that grasses and other plants are frequently preserved from destruction in winter by this means. Animals in cold latitudes or on cold mountains live on grasses, mosses, and lichens thus preserved. The reindeer does so almost exclusively ; again, the horse's habit of pawing the ground is probably a remnant of his old habit of scraping snow away from the plains.

Professor Miall points out that the breathing of this air is the reason that men and sheep buried in the snow for some time are often recovered alive. He quotes the case of an old woman who was buried in 1712 at a Dorsetshire village at six o'clock on a Monday evening. She was not discovered till the following Sunday afternoon, but was still well enough to call out to a man, who found her by pushing a stick into the snow, not to push so hard. She eventually quite recovered.

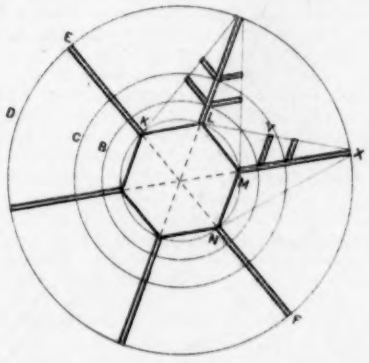


Fig. 3.

That snow is formed by the cooling of wet air should be learned by all. There is the story of a ballroom in St. Petersburg, in which snow formed and fell when the too great heat necessitated the opening of some windows. It is necessary to prove that air contains moisture, and that cold air contains less than hot. A tin can holding ice, or better, freezing mixture, answers both requirements by becoming coated with water globules at once as it chills the air. If the air happens to be fairly dry (speaking accurately, if its dew-point is below freezing-point), the freezing mixture

shows also that water can pass straight from vapour to ice as in snow, since then hoar-frost forms on the can.

An allied topic is the accumulation of snow on mountains, and the resulting avalanches. The cold increases on ascending high mountains till it reaches freezing-point, even in summer. Here snow will not melt, and accordingly accumulates till the weight becomes so great that sliding results. Two experiments will illustrate this. Slope a drawing-board till a book just refuses to start sliding down it. On the first book put others, one at a time. Sliding soon starts. Next prop up a slate or smooth tile, and on it sift flour from a flour dredger. It is best to rehearse this, to find the greatest angle at which flour will settle at all, which prevents much waiting for the result. Sift the flour on very gently. A heap forms; soon little flour-slips occur down its sides; and at last a most formidable avalanche of flour clears away half the heap.

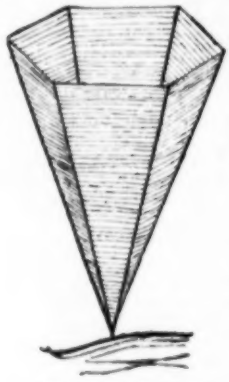


Fig. 4.—A Funnel-shaped Crystal of Hoar-frost.

Why snow should form in hexagonal crystals is unknown, but why from a single hexagonal crystal a six-rayed star should form can be studied simply. The answer falls into the following steps:—

Dissolve in hot water, kept over flame, a good deal of nitre. Serve out to groups of children the solution in warm test-tubes, and a single fair-sized nitre crystal at same time. Let them simultaneously drop in the crystal and watch it grow. It does grow. There is no formless mud of nitre deposited, but a mass of bars and spikes growing up into the liquid. Hence (1) solid particles as they form attract each other.

A given mass of solid will have most chance of attracting when it presents most surface; or, a given particle when most exposed will have most chance of attracting another. Nitre crystals are long shaped. Cut out a little bar of soap or cheese, shaped like an ordinary bar of soap, and cut it into cubes by cross cuts. Then each end cube has five sides exposed, each of the others only four. Hence the nitre crystal ought to be growing all ways, but growing lengthwise most. See that it is, and the second fact is established—(2) the attraction of forming solids, and therefore the growth of crystals, roughly correspond to the amount of surface exposed per unit of mass. The best way to see this lengthwise growth is to heat up the nitre solution again and pour a few drops on the slips of glass brought by each child. Almost immediately little needles of nitre form at the edges and grow visibly inwards. The resulting effect strikingly resembles ice formation, both in the pattern produced (as on a frosted window) and in the crystals standing in relief above the water, as in ice on puddles. It will be noticed that the formation of the first crystal is not touched on at all here. It is constant for each substance and determined by unknown causes. A very nice corroboration of (2) is the crystallisation of common salt. If a strong salt solution is exposed to the air, evaporation ultimately leads to the deposition of crystals which are cubes. As the cube grows, the new *corners* are farther from the old ones than are the new *edges* from the old, and these farther apart than are the flat surfaces.

Take now a first hexagonal ice crystal. The particles at the corners will have the most exposed surface, then those at the edges, last those on the surfaces; accordingly, particles forming solid around the crystal are attracted most at the corners, and root there. Each one so doing has all but its surface of attachment exposed. Therefore it has great chances of attracting a second—and so on, a ray shoots out. The ray is more likely to lengthen than thicken, because the supply outwards has not been depleted by the formation of either central crystal or ray. An exercise is to draw a hexagon, with a number of small squares or circles near it to stand for particles, and then build up rays by making the squares (numbered) thread themselves on at the corners.

It is interesting to note that the edges also grow occasionally, and, as might be expected, at an angle to the plane of the star. This may be seen sometimes in hoar-frost (by the use of a lens). The result is a crystal shaped like a hexagonal funnel, whose apex is in reality a minute hexagonal plate.

ENGLISH LITERATURE.

THE serious study of English literature, except as recitation, seldom finds a place in elementary schools. The subject is not specified in the Code, and probably many consider that is a sufficient reason for neglect. Further, were its claims pressed, it would be urged that the curriculum is already overcrowded, and additional time could not be found for it.

No argument is needed to prove the value of literature—every educated person admits it at once; and if so, cannot we by some means or other find a place for it, even at the expense of something else? For my own part, I should banish all study of grammar except that which relates to analysis, and gain time in that way. Even in the case of analysis, if the work were simply oral, twelve months should be sufficient for all practical purposes.

I have no doubt many will object to this abandoning of grammar, and that the familiar argument in its favour—that it is a valuable exercise in reasoning—will be adduced. But is it really as valuable as many imagine? Reasoning consists essentially in the recognition of similarity (or its opposite), and the drawing of conclusions in consequence. Where, however, the likeness is so obvious as to require no effort of recognition, there is practically no act of reasoning. Many of the distinctions of parsing—for example, *number*—are so easy as to be known at once; in fact, the child is familiar with them before studying grammar at all. Others—for example, *mood*—are so difficult as to be beyond his comprehension; while the really valuable ones—for example, *case*—are dealt with in analysis. Even etymology is often a hindrance rather than a help, owing to the child's ignorance of other languages, and also because of the great changes in meaning which roots, prefixes, and suffixes undergo. Lastly, the study of grammar frequently results in the learning of definitions largely meaningless to the child; and I am perfectly convinced, from long observation and experience, that if the time devoted in the past to the weary study of grammar had been given to literature, teachers and taught alike would have benefited enormously.

If, then, we decide to include some study of literature, what is the best course to adopt? As I have said, recitation already forms part of the curriculum; and no one would willingly consent to any change there except to increase the amount committed to memory. When we remember that from the age of seven to fourteen verbal memory is at its best, it seems a great pity that some of its energies, at present wasted in acquiring a number of useless facts, should not be utilised in storing the mind with more of the best thoughts of our literature.

The poetry selected for recitation should, of course, be of the best. At the same time, in endeavouring to satisfy this requirement, some have gone too far. The tragedies of Shakespeare, the poetry of Shelley and Keats, and all similar verse, are unsuitable even for upper classes, yet are not unfrequently chosen. If we could only realise the limits of the child's intelligence, we should make fewer blunders. A more serious matter is the probability of our creating a dislike instead of a taste for literature by taking such difficult pieces.

Another important matter is variety. The same poetry sometimes does duty year after year, and the choice of many schools is limited to two or three well-known selections. One can sympathise with the inspector who, on hearing a child begin,

"Oft have I heard of Lucy Gray,"

flung down the book, exclaiming, "Oh, hang it, so have I!" So many good selections of poetry are now published at so small a price that a varied choice is within every one's reach.

On the whole, short poems or selections from longer poems are preferable to long continuous pieces. One hundred and fifty consecutive lines from a poem of Scott or Byron do not appeal strongly to children, nor are they as good for our purpose as the shorter pieces. In addition, very short passages, or even only a line or two containing some specially fine thought, might also be committed to memory. The following, from *Richard II.*, occurs to me at the moment:—

> "The purest treasure mortal times afford
> Is spotless reputation: that away,
> Men are but gilded loam, or painted clay."

Here is an aspect of indirect moral education which seems capable of considerable development.

The treatment of a poem to be learned ought to present little difficulty, yet the faults here are probably the most serious of all. Obviously we should first deal with the various circumstances relating to the poem. To begin with, "The Burial of Sir John Moore," without any reference to the Peninsular War and the retreat to Corunna, would render its appreciation impossible. Next, the poem would be taken as a reading lesson, with rather more attention to expression, meanings of words and phrases, and allusions. Finally, it would be committed to memory.

It is in dealing with meanings and allusions that the gravest errors arise; and it is no exaggeration to say that the method often adopted is calculated to create a disgust instead of a liking for literature. An article on this point, "Against Poetry as a School Subject," which appeared in the August number of *The Journal of Education*, should be read by every teacher. An altogether disproportionate amount of time is spent on the meanings. Words are explained which are quite clear, etymology and even philology are requisitioned, and allusions receive an inordinate amount of attention. The poetry cards, too, issued by some publishers are little short of an abomination in this respect. It seems as though we wilfully set ourselves to make the pupils hate literature. There seems to be a fixed idea that unless a child can give the exact equivalent of every word and phrase, he cannot possibly understand the poem. As a matter of fact, if he comprehends the general drift of a passage, etymologies and elaborate detailed explanations may be safely neglected.

Probably the demands of examiners largely account for the undue importance attached to such matters. We see it exemplified in even a worse form in the notes appended to many editions of English classics. We constantly hear the complaint that children do not care for literature, and never willingly study it. Is it likely under such conditions? Even for junior examinations tragedies of Shakespeare are prescribed, and the evil further exaggerated by the questions usually set. After all, the notes are really the editor's attempt to satisfy the examiner. Possibly we may see a reform some day, but until it appears there is little hope of cultivating an interest in and liking for literature.

Fortunately, in the elementary schools the general study of literature, other than recitation, will be practically confined to systematic reading, without special preparation for any examination. Both reading and English lessons could be utilised—in fact, all spare time which could be saved from other subjects might be well occupied in this way. Both prose and verse should be taken; and, happily, expense is no longer an obstacle when penny editions of many works are available. Fairy stories, stories of animals for the younger ones, good books of adventure and travel and some of the best novels for the older children, are what we want, together with some good collection of poetry. Even the infant school can be provided for, since the language of many of the fairy stories is quite as simple as that of the prepared primer, and infinitely more attractive.

The novel is the most suitable when abridged. There is much even in Scott which does not appeal to children, while Kingsley's *Westward Ho!* fine though it is, will never attract children in its original form. So long as what is selected is not tampered with, there is no loss, but rather gain.

As to method, silent reading should be largely employed, especially in the upper classes, but of course under the direction of the teacher. Further, questions should be put from time to time to test what is being done. These should rather deal with main incidents than with details and meanings of words. Occasionally the teacher might read for a short time, but the main purpose of the method—namely, to teach a child how to read a book and master its contents for himself—should always be kept in mind.

In the case of younger ones, the mechanical difficulties of reading almost compel the teacher to proceed as in an ordinary reading lesson, though, as I have already said, many of the fairy and other children's stories now published are in very simple language; and it is astonishing what efforts little children will make to master new words when the reading matter is attractive. After the story has been once read through, they might certainly be left to themselves to read it again. Afterwards, several might tell the story over again, the others listening and correcting where necessary, while the teacher might also put a few questions at the close.

School libraries are undoubtedly of great help, but in poor schools the practical difficulties are too great. The homes of the children are often of such a kind that the books rapidly become unfit for use. As an alternative, a magazine club would prove of great value. Many of the best magazines contain work by good writers, and old numbers can usually be obtained for very little.

The magazines would, of course, be kept at school, and would be available, say, for a short time before opening, during the dinner hour, and also at recreation times when the weather was unfit for play. Some room should be selected as a reading room, and monitors appointed to distribute and collect magazines; or, better still, each class might have its own set, if sufficient papers could be obtained, and then these could be exchanged at regular intervals.

I have only indicated in a general way the plan I should follow with regard to the inclusion of literature in the curriculum. Much must be left to the individual teacher. So long, however, as we avoid elaborate explanations and forget the examiner's view of literature, we shall find the subject most popular. What is it that drives the average boy to the *Penny dreadful?* Cannot we direct that natural craving into a healthier channel? Even if the barren exercises of parsing and the definitions of grammar were of considerable value, their sacrifice would be justified if we sent out our children from the schools with a liking for sound literature firmly implanted in their minds. The influence of literature we can never fully estimate, because it is largely indirect, but that it plays an important part in the formation of character is beyond question.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

Needlework. } This subject is popular because it is one } in which the scholars take an active part. Young people delight in "doing," which is the natural and best method of education. The pity is that after girls have left the day schools they so frequently neglect this valuable part of their school work. This is seen at the night school. Possibly the reason is that all day-school work was dull and uninteresting. The grinding away at "specimens" for the annual examination could not well be otherwise.

Teachers still adhere very closely to the old Code requirements which they have so violently condemned as being inelastic. Would that many would set to work to adapt the scheme to the needs of the locality. Let the needlework be as useful as possible. Encourage the bringing from home of stockings and other garments that need mending. It is much more practical to be able to darn a real hole in a stocking than to fill in a slit with coloured silks in a piece of web. In some schools, I have been told, the children feel ashamed to bring their old garments for patching; but I think a little tact on the part of the mistress would remove this obstacle.

Needlework: A few Notes on Schemes.

In a large girls' school I know the elder children cut out and make complete outfits for large-sized dolls. This is an excellent practice. The girls' interest is sustained, and they vie with one another in producing good needlework. There should be more cutting out done by the elder children. It is of much more importance to a young housewife from the standpoint of economy to be clever at cutting out a garment than for her to be clever only at sewing.

Why should not even the younger girls fix the work they have to do? The teacher says she fears the garment will be spoilt. Rather the garment were spoilt, if by that the girl becomes proficient. We cradle the children too much. They are always, as it were, swimming on bladders. Only the other day I found all the button-holes for a class of Standard V. children had been cut by the teacher. It so happened they were nearly all too large for the buttons attached. Surely girls of eleven and twelve would do no worse than that themselves. Let them cut their own button-holes. This criticism holds good through the standards. I would even expect the little ones of Standard II. to fix their work. Think of the enormous saving of labour to the teacher.

The infants are fond of sewing, so I am told, but it is a mistake to look for too much from them. If sewing were deferred until the children reach the first class, there would be no harm done. In any case, let the stitches be large—about five or six to the inch—so as not to damage the sight, and be careful to arrange for this subject in all classes to be taken when there is plenty of light.

THE "NOTEBOOK" QUERY COLUMN.

Letters intended for this column should be addressed "Inspector," care of Editor, PRACTICAL TEACHER. Only in very urgent cases can replies be sent by post, and then only when two stamps accompany the letter.

N. S. inquires whether elementary science is compulsory for the King's Scholarship Examination. His reason for asking is that this subject is stated to be optional in the schedule of the pupil-teachers' curriculum, but there is no note to that effect in the King's Scholarship syllabus.

Answer.—I should say elementary science is optional; but if you take it, your position in the list would probably be much higher.

R. L. asks if it is necessary to obtain the Elementary Drawing Certificate before completing the final examination for the Teacher's Certificate.

Answer.—No.

Hona wants to know whether those sitting to raise their certificates have to take the whole examination now there are not two parts.

Answer.—The official reply runs—"Candidates who wish to raise the qualification under Art. 62*a* must now take the whole of the examination, even if they have previously passed in Division I. or II. in one of the former parts of the examination."

De Serf asks:—

1. Can I become a teacher in an elementary school by passing Oxford Senior or 1st Class College of Preceptors? and what subjects does the Board of Education require you to take in your examination?

2. Which of the two above-mentioned examinations do you advise me to sit for?

3. Where is all this information published, and can I procure the same?

Answer.—You do not say what your intentions are. What is your age?

1. The Oxford Local Examination for senior students (provided that English is included among the groups in which the candidate has passed) and the First-class Certificate of the College of Preceptors (provided that the candidate has passed in (1) English history or geography, and (2) in Euclid or algebra) are both recognised by the Board under Art. 51 (*b*), which allows a person to be an assistant teacher.

2. I can hardly advise you, not knowing your scholastic history.

3. Buy the N.U.T. edition of the Education Code, 1s. net. You will find all the information on page 55. If you have an ordinary edition of the Code, look at Schedule IV.

Woden asks what course of preparation would be best in physiography (Certificate Examination, 1903), and what text-books would be suitable for the nature-knowledge course.

Answer.—Gregory's *Elementary Physiography* (Nelson, 2s. 6d.). Nature Knowledge: there is no set book which quite covers the syllabus. Hygiene: *The Normal Domestic Economy* (3s. 6d.), or Ethel Lush's book (Macmillan).

R. asks whether a school attendance committee can compel the attendance of children between 13 and 14.

Answer.—See N.U.T Code, page 187 (3): "If the bye-laws do not extend to these children, then they must attend school until they have *either* passed Standard IV. or have obtained a certificate of having made 350 attendances after five years of age in not more than two schools during each year for five years." Such children "come under the operation of the Act of 1876, and cannot leave school without complying with the terms of that Act."

D. asks whether the year of employment needed before taking the Certificate must be completed before the first day of the examination.

Answer.—Yes.

S. asks whether those sitting to raise their certificates need read and recite again.

Answer.—The latest information is to the effect that all candidates so sitting should read, recite, and teach again.

Justice has passed Part I. of the Second-year Certificate Examination, and possesses several drawing certificates, including blackboard. He has twice satisfied H.M.I. in reading, recitation, and teaching. He asks me whether the Board of Education ought not to make provision for such cases.

Answer.—Justice has my sympathy. The new regulations certainly seem to press hard upon such as he. It would hardly become me, however, to express an opinion. I advise his managers to write to the Board.

E. R. W.—K.S. begins December 16th.

OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

TEA.

Indian *v.* Chinese Teas in the British Market.

IT is a long time since Pepys recorded, "I did send for a cup of tee, a China drink of which I had never drank before." It certainly was not a popular beverage, for four years later (1664) the East India Company presented to the king two pounds two ounces of *thea*. Viewed in the light of modern times this would by no means be considered a princely gift; but then the price was from 40s. to 50s. per pound, and an Act of Parliament imposed a tax of 8d. upon every gallon of tea made and sold.

The new drink was viewed with considerable suspicion, and the "base, unworthy Indian practice" was stated to be "not less destructive to the animal economy than opium." Still the custom steadily gained adherents, and in 1757 we find Dr. Johnson describing himself as "a hardened and shameless tea-drinker, who with tea amused the evening, with tea solaced the midnight, and with tea welcomed the morning." Nowadays tea stands in no need of apologists; its devotees now include more than half of the population of the whole world. Doubtless, when taken in excess, it produces various forms of nervous irritability; but when used in moderation we may readily agree with Lo Yu, a Chinese writer of the sixth century, who said, "It tempers the spirits and harmonises the mind, dispels lassitude and relieves fatigue, lightens and refreshes the body, and clears the perceptive faculties."

Tea dates back in Chinese legends to 550 B.C., and until the nineteenth century China and Japan were the only tea-

producing countries. The Dutch introduced it into Europe in 1610, and retained a monopoly of the trade until the East India Company began to supply the British market.

China.—The cultivated tea plant of China and Japan is an evergreen shrub which grows to a height of three to five feet; the stem is bushy, with very leafy branches, the leaves are alternate and elliptical, the flowers are white and slightly fragrant. The plants are not well established until they are three years old, by which time they throw out young leaves in great profusion. It is the leaf-buds, the expanding leaves, and the young shoots that are most required. Both black and green teas can be obtained from the same leaves; the colour is the result only of a difference in treatment. In the case of *green* tea the leaves are dried in heated pans immediately after gathering; in the case of *black* tea the leaves are exposed to the sun and air, during which a slight fermentation takes place with consequent discoloration. Notwithstanding this, separate districts produce one kind or the other, and seldom both. Landed property is very largely subdivided in China, and the tea is largely cultivated in small gardens, where the plants are tended and the leaves are picked by the cultivator and his family. Early spring (April) is the time of the first picking, when the plants produce their best leaves, which yield the famous *pekoe* and *hyson* varieties of tea. Other gatherings take place in May, June, and August, the last-named producing tea only of very inferior quality.

India.—It is probable that the indigenous tea tree of Assam is the parent of all cultivated varieties of the present day. It prefers a jungle situation, where it grows to a height of fifteen to twenty feet, with leaves nine inches in length. Officials of the East India Company, about 1820, investigated the probable utility of the native plant. It was reported to be not a tea plant but a variety of the camellia, a conclusion which applies with equal force to the China variety. For some years nothing was done in the matter, but in 1836 one pound of Assam tea reached London, and the next year five pounds; in 1838 twelve small boxes arrived, and eight times as much the year following. These early samples were produced from the indigenous plants. The cultivation of tea in Assam does not really date earlier than 1851. Seeds of the Chinese plant were obtained; they were germinated on the voyage, and reached their destination in excellent condition. Success was attained almost from the first, which caused a wild speculation in tea companies which almost ruined the industry. It was found that in the Himalayas were vast areas suitable for tea plantations, which have extended and multiplied in a remarkable manner. In 1900 the total area under cultivation was 493,000 acres, of which 331,000 were in Assam, and 133,000 in Bengal; the North-West Provinces, Punjab, and Madras account for nearly the whole of the remainder. The dimensions of this comparatively new industry may be grasped from the total exports of tea during the last two years:—

1900–1	190,305,000 lbs.	£6,367,000
1901–2	179,685,000 lbs.	5,432,000

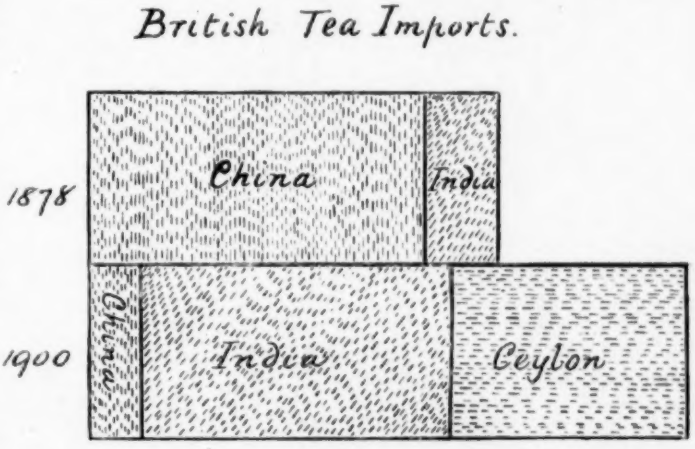
Ceylon.—It was not until 1869 that the cultivation of tea attracted attention in Ceylon. In that year a mysterious fungus attacked the coffee trees in the island; notwithstanding all attempts to cope with the pest, the coffee trade was ruined. The planters turned their attention to other commodities, and found salvation in tea. In 1878 the exports of tea amounted to 3,515 lbs.; in 1900, about 130,000,000 lbs.

South America.—*Maté*, or Paraguay tea, the tea of South America, must not be confounded with that of the Old World. It is the product of a species of holly called *yerba*, which is found wild along the river banks of Paraguay and in the mountainous regions of Brazil; the plant is also very largely cultivated. Maté appears to have been used by the Indians from very remote times, but the Jesuits were probably the first to seriously attempt its cultivation; even now it is frequently called *Jesuits' tea*. The leaves are prepared by roasting and pulverising, although in the Parana district it undergoes the same processes as Chinese tea. It is of a less agreeable flavour than tea, but as it does not readily lose its flavour it is particularly valuable to travellers. The Guachos of the plains spend incredible times in the saddle, supported and invigorated by copious draughts of maté. In 1900 the total quantity of leaf exported from Paraguay was valued at £111,816.

The Chinese tea plant was introduced into Brazil as early as 1810, and a colony of Chinese was established near Rio Janeiro. The climate, however, did not prove favourable. The plants were attacked by disease, and the Chinese abandoned the plantations; several later attempts proved equally unsuccessful. During recent years, however, all difficulties appear to have been overcome, and Brazil now grows a large amount of tea for home consumption.

Australia and Natal are also cultivating the tea plant with considerable success.

British Tea Imports.—It is impossible to say how much tea China produces per annum; in 1900 she exported to foreign countries more than 1,600,000 cwt. The United Kingdom at one time depended almost entirely on China for its supply, whereas Indian and Ceylon teas now almost completely monopolise our markets. The remarkable progress of British-grown teas is shown in the appended figures and the accompanying diagram.



TEA IMPORTED INTO THE UNITED KINGDOM (IN MILLION LBS.).

From	1878	1900
China.....	166	21
India.....	35	154
Ceylon.....	—	114
Other countries.....	4	10

The increase in consumption is very marked, but the alteration in the source of supply is still more remarkable. In 1840 we consumed 1¼ lbs. per head; in 1900 it was 6 lbs.

In 1901 the customs duty on tea amounted to no less than £6,264,000. The raising of the duty from 4d. to 6d. per lb. is considered by tea-planters and merchants to be likely to have a disastrous effect on the tea trade generally. In 1881 the duty was 6d., but the average price in London was 1s. 5d. per lb. Ten years later the duty was 4d., and the price 10½d. per lb., the duty being equal to about thirty per cent. The average price of tea is now 6d., and the duty is 100 per cent. To make up for this there is an increased call for teas of poorer quality, which is practically a direct impetus to coarse plucking, a policy which cannot have a favourable effect on the industry.

Cocoa and coffee are increasingly competing with tea in the home markets. The duty on the former ranges from 1d. to 2½d. per lb.; on the latter it is 1½d. Coffee is 8d. per lb.

and the duty is only twenty-five per cent. of that on tea. In 1879 the import of cocoa amounted to ten million lbs.; in 1900 it had risen to thirty-seven million lbs.

Of our tea imports, quite eighty-four per cent. is British grown. From thirty to thirty-five millions sterling are invested in the plantations, which provide quite five per cent. of our whole national revenue. On the other hand, cocoa and coffee are largely foreign products. The additional recent impost on sugar caused a considerable outcry, yet ninety-four per cent. of our sugar is obtained from foreign commercial competitors. To the lay mind it seems that the tea trade bears more than its fair share of taxation.

A LESSON ON THE STUDY OF A PICTURE.

"THE 'TEMERAIRE' TUGGED TO HER LAST BERTH."
(Turner.)

BY FRANCIS J. FROST, B.A. (OXON.),
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(See Supplement presented with this number.)

IN this lesson the teacher should try to make use of what has been taught in the two previous lessons. The pupils should be led to look for excellences similar to those noticed in the pictures previously treated. For this purpose the business of the teacher in preparation (Step I.) is to call up in the minds of his pupils the important ideas they possess, and which are likely to be of service now.

I. Preparation.—Remind pupils of previous lessons. Get names of pictures—(*a*) "The Angels;" (*b*) "The Last In."

Invite students to relate what they remember about these pictures.

The teacher will doubtless find it necessary to assist the memory by judicious questioning.

The chief points should be noted down on the blackboard. They would appear somewhat as follows:—

1. "The Angels" was painted by Reynolds.
"The Last In" was painted by Mulready.

2. In both we find that the artist did not merely copy nature, but tried to depict an ideal beauty conceived by the power of imagination.

3. These two pictures were carefully "composed."

(*a*) Each of them has one definite meaning, and every part of the picture points to this.

(*b*) By means of carefully-concealed lines, the eye is guided as the artist wished, and so the attention is drawn to the chief parts of the picture.

4. The artist tries to express his emotions through his pictures.

These facts should be well known before proceeding, and possibly a revision lesson may be found necessary. In that case this lesson would form the preparation for what follows.

II. Presentation.—(*a*) Show the picture, mentioning title and naming the artist.

(Pupils might be informed here that people who have tudied the subject of pictures are able at once to appreciate much of what the artist felt and meant when he painted his picture. They might themselves be able to appreciate something of all this.)

(*b*) After pupils have had time to examine the picture for themselves, ask—

"Does the sight of this picture call up in you any sort of feeling?"

"Mention in one word, if you can, its effect on you."

(This might be written down; and probably the following words, among others, would appear—sad, dreary, solemn, gloomy, dull. Pupils are, however, likely to be shy of expressing their feelings, and they should not be urged too much. They should all, however, be told to look out for fuller appreciation during the course of the lesson.)

(*c*) Proceed as follows:—

"What is this scene?" (A seascape.)

"Mention all the objects you notice in the picture."

"Do you notice anything unusual?"

(Here refer to the great loss, owing to absence of colour. They should see the original at the National Gallery, and then would be seen "the light that never was on sea nor land," but which Turner, the poet-artist, has caught by an effort of genius.)

The two vessels are each in contrast to the other.

The one is stately, beautiful, tall, suggestive of death, and almost spectre-like.

The other is clumsy, ugly, insignificant, aggressively vigorous in an otherwise tranquil setting, being indeed the very embodiment of active life.

From this picture colour is absent; nor can it be inferred that the time is evening, and the sun is setting behind fantastic clouds dimly seen through down-dropping mist.

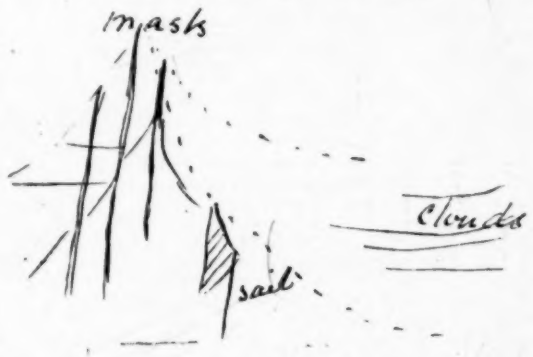
(*d*) Now call attention to the *composition*.

Ask—"Does your eye rest particularly upon any part of the picture, for it is usual for every good picture to have some such resting-place?"

(The tall ship is, of course, the chief centre of interest, and probably many of the students will realise this.)

Let pupils now try to find out in what manner the artist has arranged the concealed lines by which the eye of the spectator is guided.

(Refer to "The Last In" for former example of this; and after allowing pupils to find out for themselves, show clearly by tracing with pointer, or by means of simple sketch on the blackboard, that lines on the right from the clouds, and on the left, sweep up through sails and yards to the mast-heads



of the stately vessel. It is to this, then, that the thoughts are led; and the picture therefore can best be interpreted when we understand the meaning of this ship. All the rest of the picture is accessory to this, the object of central interest.)

(*e*) Its effect upon the *emotions*.

By this time the pupils will have mastered the chief elements of the picture, and will have experienced various emotions as new ideas will have been borne in upon them. They should now realise how nature in sunset-gloom, and by the strange light which makes ghost-like the *Temeraire*, while throwing into deep shadow the tug, is in sympathy with the almost human suffering here depicted.

Let the pupils consider this picture, and say in what respect it differs most from each of the former pictures.

(Here we are not concerned to study men, women, boys, or girls. The human element is almost lacking. Yet the artist has succeeded in expressing very deep feeling, and in calling up similar emotions in those who can see the full meaning of this picture.)

Refer to the words of Ruskin: "Of all pictures not visibly involving human pain, this is, I believe, the most pathetic ever painted."

Call attention to the arrangement of the masses of black shadow, and ask for an explanation of the heavy gloom upon the extreme right.

(The *Temeraire* appears to be moving towards the gloomy region, suggestive, perhaps, of the land of the "shadow of death." But the heavy shadow is also placed there for artistic purposes—it balances the blackness of the tug and its shadows.)

III. Association.—Associations have been dealt with in the course of the presentation.

Other associations which may possibly be useful:—

(*a*) The whiteness of the vessel suggests the pale face of the dead.

(*b*) With Turner, the poet-artist, may be compared Blake, the artist-poet.

(*c*) "The highest art is to conceal art," in reference to the construction lines of this picture.

IV. Formulation.—Pupils may now be set to write out—

(*a*) A list of the elements of this picture.

(*b*) The meaning as now known.

(*c*) An appreciation, showing reasons for their final opinions, and expressing the emotions which the picture now produces in them.

V. Application.—Now that the picture is understood, the pupils might be set to examine it more closely at leisure, and to find out details which can only be explained in the light of what they have now learned.

(The artist intended to depict a funeral procession. Nature sorrows at the loss of the *Temeraire;* white-sailed vessels follow her to her last home, while the little tug leads the way with flaming torch.)

Some reference to the *Temeraire* and its past history must be made during the lesson, but pupils should be set to read up a fuller account for themselves.

They should also read an account of the life and work of Turner.

PHYSICAL TRAINING.

A PROGRESSIVE COURSE FOR ELEMENTARY SCHOOLS.

BY H. RIPPON-SEYMOUR, A.C.,

Chief Instructor, George Watson's College, Edinburgh; Member International Congress of Physical Education, Paris, 1900; Author of "Physical Training," etc.

SECOND LESSON.

"Positions" and Simple Physical Exercises.

(The words of command are in heavy type.)

"POSITIONS" FOR THE UPPER LIMBS.

15. "**Hands on—Hips.**"—Place the hands on the hips with the fingers pointing to the front, the thumbs to the rear, elbows pressed backward, the body otherwise as directed for the position of "attention."

15*a*. The command "**As You—Were**" may be given when it is necessary to bring the pupils back to the position indicated by the previous order from whatever position they may be in at the time.

16. "**Hands behind the Head—Place.**"—Carry the hands quickly behind the head, interlocking the fingers, and rest the head in the support thus made. The hands must not be allowed to pull the head forward, the elbows must be pressed back, and the head held erect. (Fig. 1.)

17. "**Arms Behind—Fold.**"—On the command "fold," carry the arms behind the back, and when there let the right hand grasp the left upper arm, and the left hand support the right elbow. The body must be held erect, or it will be impossible to grasp the upper arm as directed, and the teacher should move behind the class to see that the correct position has been assumed. (Fig. 2.)

18. "**Hands above the Head—Raise.**"—Raise the arms to the front and above the head, the thumbs interlocked (or hooked together), arms and fingers quite straight, and pointing directly upward, palms to the front; head erect.

"**As You—Were.**"—Drop the hands smartly, and resume the position of "attention."

All the foregoing positions should be repeatedly practised until the pupils are able to assume them correctly and instantly.

"POSITIONS" FOR THE LOWER LIMBS.

19. "**Heels—Raise.**"—Rise slowly on the toes as high as possible, with the knees straight.

20. "**Heels—Lower.**"—Quietly resume the position of "attention."

In repeating this movement the words "raise" and

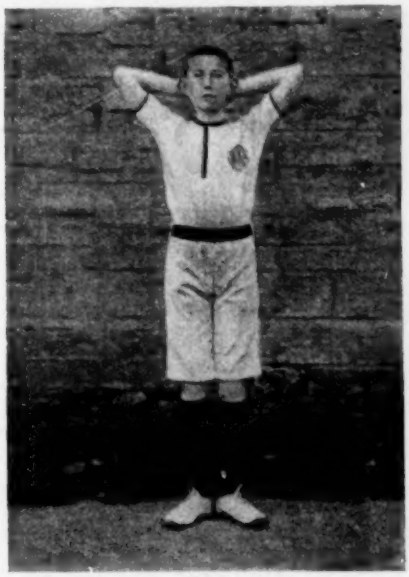


Fig. 1.

"lower" will be sufficient after the first time. In ordinary drill the movements may be repeated eight to sixteen times.

Whilst teaching the lower-limb positions, it will be advisable to order the pupils to place "hands on hips," or to assume any other of the positions before described.

21. "**Class—Astride.**"—Carry the right (or left) foot eight or ten inches to the right (or left), the weight of the body being equally over both feet.

"**As You—Were.**"—Resume position of "attention," moving the same foot which was previously carried away.

Fig. 2.

22. "**Toes—In.**"—Raise the toes slightly from the floor, and bring the feet close and parallel to each other.

23. "**Toes—Out.**"—Raise the toes as before, and resume the proper position of "attention." Repeat these two movements until they can be performed without "shuffling.'

THE LUNGE.

This movement or position is scarcely suitable for children under seven years of age.

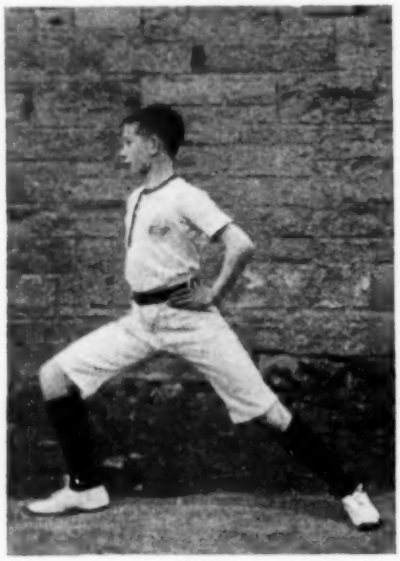


Fig. 3.

24. "**Right—Lunge.**"—On the word "lunge," step out with the right foot a full pace (nearly twenty-seven inches) to the right (a quarter circle from the front). The left leg must be kept straight, and the left foot flat and firm upon the floor.

Bend the right knee well over the toes, the right foot being turned in the direction of the lunge. Keep the body erect from the hips upward, the shoulders either square to the front or turned in the direction of the lunge. (Fig. 3.)

"**Two.**"—On the command "two," the pupil will recover the position of attention by pressing strongly against the

Fig. 4.

floor with the right foot and carrying it quickly back, clear of the floor, to the left.

25. "**Left—Lunge.**"—As directed for the "right lunge," substituting right for left, and *vice versâ*.

"**Two.**"—As before.

PHYSICAL EXERCISES.

26. "**Bending the Knees.**"—"**One.**"—Rise on the toes as before described.

"**Two.**"—Keeping on the toes, bend the knees, spreading them well apart, and slowly lower the body to a sitting position, heels pressed together; the column of the body and head erect. (Fig. 4.)

"**Three.**"—Slowly straighten the knees, and resume the first position, still on the toes.

"**Four.**"—Sink quietly on the heels as in "**Two.**"

Repeat this movement six or eight times.

Whilst performing this and subsequent exercises the hands may be placed on the hips, behind the head, or folded behind the back, as desired. The two latter positions, however, add greatly to the difficulty of the movements.

27. "**To the Right (or Left)—Bend.**"—Bend the body slowly to the right (or left) as far as possible, keeping the legs straight and the shoulders square to the front, the head moving with the body.

"**Two.**"—Slowly resume the erect position.

Repeat several times to each side.

28. "**Forward—Bend.**"—Keeping the knees straight, bend slowly forward from the hips, the head to be held up as far as possible.

"**Two.**"—Slowly resume the erect position.

29. "**Backward—Bend.**"—Bend the body slowly backward as far as possible, the face upward, the knees slightly bent, to assist in maintaining the equilibrium.

"**Two.**"—Slowly straighten the body.

COMBINATION EXERCISE (NOS. 18, 21, AND 28).

30. "**Hands above the Head—Raise.**"—As before.

"**Class—Astride.**"—As before.

"**Forward—Bend.**"—Bend slowly forward, and, keeping the knees perfectly straight, endeavour to touch the floor with the tips of the fingers.

Care must be taken that the knees are not allowed to bend in the endeavour to reach the floor. Practice alone will eventually enable every pupil to perform this movement correctly.

"**Two.**"—Resume the first position.

Repeat this movement several times, and then give the command "**Attention,**" when the hands are dropped smartly to the sides and the correct position assumed.

"**Stand—Easy.**"

THE CHOICE OF IDEALS.

BY B. DUMVILLE, B.A., L.C.P.

"Who but the poet was it that first formed gods for us; that exalted us to them, and brought them down to us."—GOETHE.

STRICTLY speaking, an ideal is the highest conception we can form of anything. We may and do conceive ideals in many spheres of thought. But perhaps the term takes on its fullest meaning when it is used in the moral sense. Although, like all concepts, the ideal is built on reality, it does not follow that anything exists exactly corresponding to it. We see *some* good in many characters, and we are led to imagine a being in whom *all* is good. Apart from the creations of poets and romancers, there is only one life which is widely admitted, in Christendom, to come up to this standard. But, in ordinary language, we extend the meaning of the term *ideal* to denote all those characters which, though lacking absolute perfection, are so much higher than the general level of humanity that they are a source of inspiration to the rest of mankind. Socrates and St. Paul are thus ideals of antiquity; while the lives of Wesley, Gladstone, and Gordon are considered by many as among the best of modern examples.

There is no doubt that ideals of some sort play a very important part in directing human action. Even among thieves, the "splendid" exploits of famous criminals have exerted great influence. And it is not perhaps too much

to say that almost every man has a vague combination of ideals to which he would like to attain. Since, then, all minds of any energy have this idealising tendency, the question of directing it into the best channels is a very important one.

Although human types of goodness fall always below absolute perfection, they may perhaps be said to possess one definite advantage over the latter—they represent what *has* been attained. Pure idealism will not stand the test of contact with real life. We are apt to fall into despair before an ideal which it is impossible to reach. But a milestone, seen clearly ahead, is a goal which is likely to encourage us to press forward. On the other hand, the counsel of Herbert,

> "Who aimeth at the sky
> Shoots higher much than he who means a tree,"

must not be forgotten, and we must be careful to select worthy ideals—those which represent the highest types of human character.

The ideals of the leaders of the nation are very important. But, after all, the aspirations of the great mediocrity are the best measure of the true worth of a people. It is to be feared that there is widespread shrinking from high types of character. The epithet "good young man" has become almost a term of reproach, and the boy who seldom or never does wrong is by no means an ideal for his comrades. The ordinary mind wants to be like everybody else, and considers a spice of "pardonable" vice an essential in the character of the "jolly good fellow." How many young Englishmen consider an occasional indulgence in excess as a sign of manliness! The desire to appear clever but lazy is not a rare one in our schools and colleges; and to get good pay for short hours is quite a common ambition. In this last sentiment many a teacher may concur. Perhaps one is hardly to blame, seeing that the feeling is often manufactured by the overreaching actions of some employers. It is the duty of the "ideal" teacher, however, to rise above his circumstances, and preach, by example as well as by precept, the doctrine of devotion to duty.

How high an individual rises in the moral life depends, firstly, on the kind of ideal which he has selected; secondly, on the amount of moral force which he possesses; and lastly, on the nature of his environment. Obviously these three conditions are not to be separated. The first is the most important, but it depends largely on the other two. The necessity of this connection is not always sufficiently emphasised. It is good that we should have men of the type of Gordon and Gladstone, but it is impossible for many to set out on the endeavour to imitate them with any prospect of success. Disappointment and apathy are often the result of failure which might have been avoided by the choice of suitable ideals.

In presenting examples of conduct to boys, we must therefore try to show that often they owe their peculiar character to special circumstances. We can, however, point out how these qualities may be imitated in other spheres. Further, it is possible to find many ideals which may be almost completely copied by the boys to whom we are speaking. And it is often better to pay somewhat less attention to the brilliant characters of history, and direct admiration to the humble lives of those who did their duty to the best of their ability, and never rose to high positions. "They also serve who only stand and wait."

The Greek ideal of the harmonious blending of all the faculties may represent one form of truth, but it is no longer fully possible in the twentieth century, when division of labour has reached such an advanced stage. A man cannot now be a statesman, philosopher, soldier, and teacher at the same time. Although a condition of mental and bodily equilibrium is still to be sought, it must exist under very different circumstances in different cases. The teacher should endeavour to show that we cannot, and should not, all endeavour to approximate to one pattern. In school, the prominence given to athletics and the admiration bestowed on its heroes cause many boys to set before themselves types of conduct which, though good in themselves, are not suitable to the special circumstances. The healthy, vigorous Englishman who courts adventure under foreign skies is no more estimable than the patient student "toiling upwards in the night." Stephenson and Watt have done as much to extend the British Empire as Nelson and Wellington. And none of these could have accomplished anything without an army of skilful and industrious workmen who put their ideas into practice. The importance of the ordinary useful member of the community is often overlooked. Without him your great men could never have shone. Indeed, he is more essential to the hero than the hero to him. Let the teacher, then, seek in the great middle class the best examples, either in fact or fiction, so that each boy may find at least one ideal towards which he feels encouraged to strive.

Many books for boys portray heroes in high walks of life, and thus breed discontent and envy on the part of a large number of readers, not to mention that form of moral cowardice which leads a boy to be ashamed of his family and circumstances. That this spirit is not confined to boys is shown by an incident which occurred only a few years back. A celebrated educationist who began as a boy in an elementary school, and who has mounted to almost the highest point of his profession, was extolled in a public meeting by a gentleman who went so far as to speak of his early days in the elementary school. Afterwards the orator was requested to confine his remarks for the future entirely to the later period of the life in question. Throughout our society there seems to be this great desire to be considered as a life-long member of the upper classes, and men are willing to sacrifice all the honour which a life of uphill fighting merits, in order that it may be thought that they were born in the position to which they have attained. Rightly judged, the humble origin is the chief glory of a life of this kind.

The admiration of great ability directed to bad ends is difficult to restrain. The teacher should try to find other great characters which represent the antithesis of the bad one. Cincinnatus going back to his farm, and Washington retiring into private life, would thus be the necessary contrasts in dealing with such men as Napoleon.

It is impossible to eliminate the desire for praise and honour; nor, indeed, is it desirable, since ambition is, directly or indirectly, the cause of most strenuous lives. But we may endeavour to bring it down to a reasonable quantity by enforcing the supreme value of self-respect. To this end such anecdotes as that of Michael Angelo working away at the back of the statue, because "the gods would see it," are very useful. Poems like Gray's *Elegy* will also be of help, especially such lines as the following:—

> "Let not Ambition mock their useful toil,
> Their homely joys, and destiny obscure;
> Nor Grandeur hear with a disdainful smile
> The short and simple annals of the poor."

Let the boys be impressed with the truth that, whether fortune bring preferment or not, all may earn an epitaph similar to that written by the poet,—

> "Large was his bounty, and his soul sincere."

It is a common thing in children's books to find the path of virtue and industry extolled as a sure means of advancement. "Honesty is the best policy" is a maxim often quoted to the young. To say nothing of the morality of such a principle, it is extremely doubtful whether strict conscientiousness is the best means to worldly success. Ruskin tells us that among the poor of this world are to be found the absolutely honest. For every good man who gains preferment, a dozen remain in comparative poverty. The man of the world knows very well that success depends on many other conditions. By preaching such doctrines to children we are deceiving them; and as soon as they find out the truth, they are sure to be filled with contempt for such teaching. The error in all this lies in attempting to show too close a connection between individual virtue and individual well-being. The teacher should, as soon as possible, lead the child from this low standard to the higher level, where the good of the community, or even of the whole race, is the guiding principle. To this end, examples of self-sacrifice should be specially dwelt on, that they may win over the children such an influence as the all too

worldly atmosphere, into which most of them must soon plunge, will not quickly destroy. The life of John Howard and his death by fever, brought on by devotion to another; the noble act of Arnold von Winkelried in the cause of Swiss liberty at Sempach; the renunciation by St. Paul of all dreams of worldly success to endure privation and persecution in the cause of truth,—all these types of nobility, and many others, will help to show that the greatest heroes are not always those who ended their days in prosperity and peace.

Lastly, the teacher must remember that he himself is in many respects an ideal for his boys. This is pre-eminently so in the case of the master who has secured the affection as well as the respect of his pupils. The writer owes the beginning of what love he has for thoroughness in learning and teaching to the example of his master in the elementary school—a man who, by his great enthusiasm, appeared in those far-off days to be one of the greatest *savants* in the world.

SOME DISTINGUISHING FEATURES OF GERMAN TEACHING.

ALTHOUGH the conditions under which the German teacher works are, in many respects, different from those obtaining in English schools, yet, even when these differences have been taken into consideration, there remains much that should be stimulating to his English brother. The high-minded teacher in both countries has ideals, and although a German's final end is perhaps not so much to become a good citizen as a good soldier, his immediate concern is to become well educated; and the German teacher, in order to meet his demand for good education, has not merely to learn the mechanical parts of his craft, but to look for principles of education, and, having found them, to apply them for all they are worth. This is the keynote of his teaching—to look for principles rather than "wrinkles," and to despise no theory, however airy and unpromising it looks, until he has tried it well in the furnace of practical experience. When a new device travels from Germany to England we are apt to overwork it, and then to reject it as unpractical and impracticable, while the German teacher, instead of using it as a shibboleth, is busy modifying it to suit his ends. A case in point is the device of the "complete sentence" used with such dire effect by many a "trained" teacher. In Germany the complete sentence is not a bogey, as it often is with us, for the simple reason that its application in individual cases is conditioned by a little discretion. Let me give an example of what I regard as the misuse of this method as seen in England, and contrast it with the more sane application of it in Germany.

Let us suppose that an apple is to be the subject of an object lesson. The teacher, with an air of mystery worthy of a better cause, produces the apple, perhaps from the folds of the duster, and asks in an awe-struck whisper, "What have I in my hand?" An impetuous youngster shouts, "An apple!" Whereat the teacher assumes an air of injured virtue, and demands a complete sentence—for example, "You have an apple in your hand." This they may have been guilty of in Germany in the early days of the complete sentence idea, but they have modified it so that it is no longer a drag on the wheels of progress, but a valuable educational help.

Of course, the great use of the complete sentence is to foster articulateness; but this can never be done by cultivating stilted and unnatural modes of expression, and it is not natural for any child of tender age to say a whole sentence when one word is enough. The German teacher is bent on making his class talk, and in order to do it he calls upon individual children for complete accounts of what has been taught in a previous lesson, or he asks them to describe an object or a picture, one child correcting and amplifying the statements of another. As an oral lesson is in progress, and as point by point is reached, the result is made the subject of a clear, connected account, which is afterwards summarised, the children themselves again being the active workers in picking out the significant words needed for the blackboard sketch; and in this way not only is articulateness attained, but a habit of note-taking into the bargain. "*Formulation*" is made an active ally of "*presentation*," to the great advantage of both.

Of course, less ground is covered in this way than by the old-fashioned method of pouring in facts at the rate of so many to the hour; but consider the advantages weighing in its favour. The child learns the resources of its own language as a medium of thought; it is more interested because it is more active; and it learns the rudiments of the invaluable art of note-taking. These are some of the benefits; and, in addition, knowledge thus gained is more valuable, because the child itself has gained it by a system of appropriation, instead of being a mere passive recipient.

This last advantage leads us up to the use of another educational principle very much in favour with German teachers—namely, the "method of discovery," or the "heuristic method," as it is sometimes called. This method is known in England, and may be described as nothing more than the wholesale application of induction as an educational instrument. Children are set to collect data for themselves, and, when that is done, to generalise from them. This method obtains not only in physical science, but in Germany it is used in the teaching of geography, history, and even grammar and arithmetic. The school walk and school journey are instances of its application to geography teaching; and the German method of teaching this subject is coming, little by little, to be adopted in England. But we do not apply it wholesale as does the German; the German child is made to collect facts himself, even from the seemingly unproductive area covered by the multiplication tables. To build up the multiplication tables synthetically would seem to many of us a sheer waste of time, yet it gives more insight into the nature of numbers than any amount of mere rote-work.

To conclude this part of the subject. In German schools the child talks more than the teacher, and is consequently more articulate than the English child. He knows more about his surroundings, because he has been foraging for facts in these very surroundings, instead of having them brought to him and served up by the teacher. He has learnt, to a degree at least, the valuable art of collecting information for himself, and as a result is more likely than would otherwise be the case to become a genuine independent student in future years. The fact knowledge he has obtained may be less in point of quantity because of this treatment, but it is much more really a part of his mental pabulum than knowledge gained on the old rote system.

In most German elementary schools the beginnings of some form of out-door industry are taught. Thus in the state of Saxe-Weimar, where most of my observations were made, the elements of fruit-tree culture were taught. This was, of course, an extension of the "Naturkunde" course. In every village in the district was a "Baumschule," an open-air school, in which were growing fruit trees of various ages and sizes. The teacher took his class twice or thrice a week to this school, and initiated them into the mysteries of planting, pruning, soils, etc.

There is yet one point upon which I should like to touch before finishing—namely, the excellent way in which the various subjects of study are correlated in German schools. In general there is very little said about "subjects;" every subject is made, where possible, to work together with other subjects. Thus the reading-books are prepared in such a way that whatever the subject, at any rate of oral instruction, something may be found in them bearing upon the matter dealt with. In the same way the school journey serves the purposes of the geography, history, and natural science lessons; while literature is everywhere made to contribute its quota. The splendid ballad literature of Germany is utilised, wherever possible, to impress upon the minds of the children the reality of the historic facts they have been learning; legends and folk-songs are taught at proper stages, in order that the chains of association may be made as strong as possible. In short, the teacher aims at impressing upon his class the interdependence of all knowledge by establishing a connection between one subject and another.

The Practical Infant-School Teacher.

OUR MODEL INFANTS' SCHOOLS.

XII.

THE morning is dull. It is November. Between the earth and the sun is a dense fog; the gas-lamps in the streets are lighted. But the sun cares not; he is content to idle away his time behind the mist, hoping, perhaps, that when he *does* show his cheery face he will be welcomed the more heartily.

The railway station is in a worse plight than the streets, except that to the feet it is a *little* drier. The people bustle about as black spectres, the porters are cross, and the booking-clerk cannot see sufficiently clearly to give the correct change. Perhaps the air will be clearer when the town is left behind. Vain hope—it is positively worse. The writer is on his way to a school in the Black Country, to a school where he knows that, once inside, the dreary atmosphere of the smoky district will be charged with the lighter air of comfort and happiness. From the outward station the rendezvous is not very far, but the nearest way is slippery and treacherous. It leads alongside the canal and across a wide expanse of unused land. No hansom is at hand—hansoms never are at hand when they are wanted most. He must foot it as best he can. He buttons up his coat, lights his pipe, and away he goes. Plunges and slips make the journey twice as long as it is on a summer's day, but by-and-by he stumbles against the playground gate. A few moments more his overcoat is stowed away in a little room where a huge fire is blazing in the grate, coal being plentiful, and ladies' jackets are being stewed in the process of drying. While he is engaged in restoring animation to his finger tips, the mistress of the school wrings from him the promise that he will not divulge her name, nor tell, except in a vague way, what the school is called in which she works. He gives his word, and with her the round of the school is made.

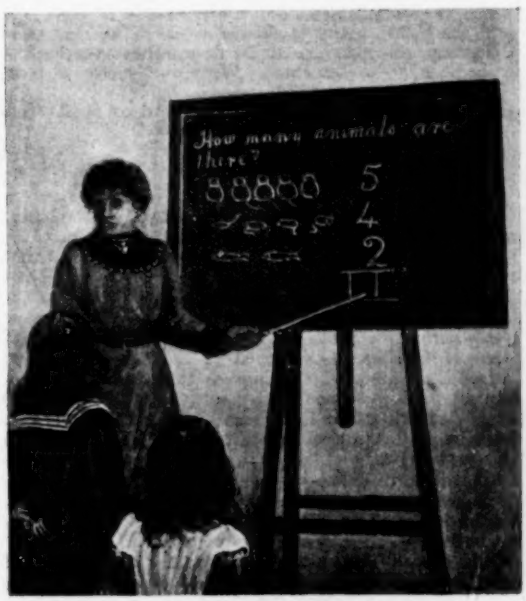
Let us look at the place and examine the company. The door opens into a rather large, long room. It is lighted this morning by twenty-four gas jets from three pendants, which can boast, if they feel inclined to swagger, of some artistic merit. The four huge windows on the left admit but little light. On the right are two good-sized classrooms. Windows rather than walls divide the classrooms from the main school. The floor is blocked, not boarded. The wainscoting is nicely polished, and there lingers about it a faint odour of furniture paste. The walls are coated with a drab-coloured wash, and the maps, the pictures, the specimen cases (such as Colman's and Hardtmuth's), and plant brackets stand in clear relief from them. The class at the far end yonder, which faces you as you enter, is seated on a gallery. There is a museum cupboard, and another cupboard not very far away from it, filled with books, and called by the name of "The Library." About these something shall be said later on.

The children are for the most part poor—the hopefuls of the British miner. They look fairly well nourished; one or two here and there are well dressed. The boys and girls alike sport pinafores which show recent washing. By-the-bye it is Monday morning. The classes in the main room are each in charge of a pupil teacher. The head-mistress works with these in a general way, but the pupil teachers are considered responsible for most of their work. The classes in the side rooms, one of which is the standard class, are taught by certificated mistresses. The number on the books is two hundred and nine, and present this morning are one hundred and eighty-seven. The classes in the main room are very quiet; all are engaged in handwork. The two nearest are copying writing on paper, and the class on the gallery is knitting. It is a girls' class for the present, and they are holding blue and red balls of wool in their laps and making lengths or strips of work.

We will leave these for a little while and visit the standard class, where through the open door something of more than ordinary interest can be seen.

Picture Arithmetic.

The school is working at the end of the second month, so that not much of the year's syllabus has been completed. This is an advantage rather than otherwise, for it is not so much results that one is so glad to see, although these are exceedingly interesting and helpful, but methods. Splendid results are to be obtained by almost any means, but good methods lighten drudgery and make the lives of the little ones happy. It is this happiness—or rather the way to get it—that we want to teach in these articles.



"PICTURE ARITHMETIC."

The standard class is at its lesson in arithmetic. The teacher believes that lessons should be real. Every exercise she sets she illustrates. She can sketch rapidly, so that this

method of teaching comes easily to her. The exercise at which the children are engaged at the moment is the third in the lesson. The problem itself was set by one of the little girls in the class, but not exactly in the form in which it appears in the illustration. It has been altered for the sake of convenience. The child's problem was as follows:—

> "Suppose there are five cats, four mice, and two fishes, how many animals would there be altogether?"

The problem was repeated by the teacher, and when every child had had the opportunity of assimilating the numbers, they wrote them in the proper way on their papers. Then they were called up to attention, and the teacher put the problem in another way—her own way—on the blackboard. This was done for the purpose of showing the children that there are more ways than one of expressing the same thing. Her way also, as we have said before, was considered more convenient for illustration. Instead of writing the word "cats," etc., she sketched the little animals, and wrote the figures opposite the drawings. Thus the exercise was made perfectly clear. Then one of the children was called upon to show how she would get the answer. The accepted way was this: "Two fishes and four mice make six animals. Now put the five cats to the six animals, and the total is eleven animals."

In reading this article it must be remembered that the class was a Standard *One*, and it is reasonable to conclude that no idea except that of numbers entered into the children's minds. The consequence of putting five cats into the company of four dainty little mice and two red herrings was not at all contemplated. Had there been a wag in the class the answer would not have been eleven, but five.

Every child but one had the correct answer, and many of them had written the word "animals" by the number eleven.

The power that illustration has over children was very clearly seen. The teacher was asked how the illustrations would serve in the case of an exercise in subtraction. There was time for another sum, and an experiment was tried for the sake of the writer. The class was told to think of a sum in subtraction—taking away. Then after a moment or two three children were selected from different parts of the class. These stood up, and in turn were asked for their sum. The result is worth recording:—

> 1. "A little boy was walking down New Street. He was carrying a basket of apples. There were twenty-five apples in the basket. And there was a hole in the basket too. Through this hole nine apples dropped from the basket as the little boy walked along. When the little boy got home, how many apples were left in the basket?"
>
> 2. "Twenty men went down a pit to get coal. Ten of them got killed; how many were saved?"
>
> 3. "Nine cows were feeding in a field. The woman fetched five of them up to milk them. How many cows were left in the field?"

These examples are written down as nearly as possible in the children's own language. The fact that the school is in a mining district accounts for the second example, while in example No. 3 the woman fetching up five "to milk them" is perfectly natural.

The question as to subtraction was raised by the writer to see whether the children quite understood that when the process of subtraction is carried on the things subtracted must be the same kind of things as those subtracted from. The examples given completely avoided a mistake being made. But this might have been an accident; so he asked permission to set a problem of his own. He said to the children:—"Now, children, you have set yourselves three very hard sums. I daresay you can do them, but I want to see whether you can do one that *I* will set. I will promise to make it very easy. If you take four apples from ten strawberries, how many strawberries will be left?"

While the children were thinking the problem over he turned to the blackboard, drew ten nice red strawberries and put the number ten by the side. Then he drew four rosy-looking apples and put the number four alongside, drew a little line for the answer, and awaited results. Many of the children were smiling; in fact, they were all very much amused. The writer pretended they were laughing at his drawing, but they declared such was not the case "Well, what *are* you laughing at?" said he. "Please, sir, because you can't do it." "What!" said he, "can't do a little sum like that, when you tiny mites can do such hard ones?" "No, sir," said they, "you can't take apples from strawberries. Nobody can."

This point had been carefully seen to in the teaching, and reference is made to it over and over again.

Examples in concrete form are set in all the classes, from the babies' upwards, and as many as possible are set by the children themselves. Intelligent arithmetic is thus secured all along the line. Just as pictures are used for the purpose of affording examples in oral work, so articles are prominent for counting. The cupboard in the babies' room is full of them. There are sticks and matches, toys and dolls, buttons and pins, and pretty well everything. Noticing later on in this cupboard several packets of "snap-cards," the writer asked for what purpose *they* were used. A packet was taken down, shuffled, and given to the little girl who sat nearest. She was told to find the sets and count them. She first of all sorted them, and appeared to be very familiar with them. When they were sorted, she counted "one, two, three, four, five," taking each set one by one till all were counted—an instance of dragging common articles into school use. The mistress encourages the children to perform these little exercises at home, and thus gets home lessons done unintentionally.

Beauty in Teaching.

The room in which the standard class is taught is exceedingly beautiful in its decorations. The teacher (certificated) has spent some years in collecting pictures suitable for children of Standard I. Publications of all sorts have been searched, and when anything of special interest, or anything that is likely to crop up in a composition (oral) lesson, has been found, it has been cut out, nicely mounted, and framed. One of T. Nelson and Sons' publications has been "mutilated" for this purpose—namely, *Puppy Dogs' Tales*, illustrated by Louis Wain. Pages 19 and 20 have been cut out. Two books are necessary for the purpose, as page 20 is at the back of page 19. Page 20 has been pasted at the bottom of page 19, and the two have been mounted as one piece on a sheet of cardboard. This has been enclosed in a neat black frame, and it forms not only a very pretty ornament, but an exceedingly useful piece of school apparatus. The picture shows a puppy fox-terrier walking in the gutter of a street. He is carrying a huge bone in his mouth, and as he walks along he is very anxious as to the bone. What makes him so is the fact that on the pavement are six other puppies—a retriever, a pug, a Pomeranian, a collie, a mastiff, and a bull-terrier. They are keeping pace with the pup in the gutter, and their expressions show that they too are anxious as to the bone. The picture in itself makes a splendid subject for a conversational or oral-composition lesson. But it has an additional value, for a well-written and child-like piece of poetry accompanies it. This is useful for learning as recitation, and as an entertainment item has been well applauded. The recitation is as follows:—

THE MARCH OF HOPE.

1. 'Twas only a gutter child—
   A poor child—
   All alone,
   Untiringly tramping the street—
   The long street—
   With a bone.

2. Close by on the pavement a throng
   Of grave folk are marching
   In silence utter;
   But each has his eye on the child—
   The poor child—
   In the gutter.

3. I said to the weary child,
   "My poor child
   All alone,
   Why untiringly tramp you the street—
   The long street—
   With this bone?"

4. He replied, "I am tramping in *hope*
The unending gutter
In silent measure,
In hope to find a place,
A lone spot,
To enjoy my treasure."

5. I asked of the throng, "Why pace ye
The pavement
In silence utter,
Each with your eye on the child—
The poor child—
In the gutter?"

6. Each answered, "I am tramping in *hope*
This pavement,
Sans murmur, sans mutter,
That the rest may be called away;
And then I shall 'go for'
The child in the gutter."

7. "What, injure the child!" I cried—
"That poor child—
For your selfish pleasure?"
"What *must* be must *be*," each replied;
"And I *must* have
That treasure."

8. So I left them all marching in hope—
The poor child
In the gutter,
And the throng on the pavement—in hope
And selfishness
Utter.

Illustrations of this kind are very easily found, and a better use than that here indicated would be difficult to imagine. Animals, scenes in London, fairy-story pictures, and country scenes are all to be seen in this room. Needless to say, the oral composition of this class is very delightful to listen to.

One word more about the pictures. The children have sometimes been set to draw them, and sometimes they have drawn them voluntarily when they have had a few spare moments, or when it has been a rainy day and playtime could not be spent in the yard. We do not advocate, as a rule, children attempting work beyond their powers; but sometimes one can learn a great deal as to *what* a child can see in a picture, and *how* he can see it if he is set to draw it. Looking through some of the examples drawn, the accompanying one was discovered. The attempt is certainly a fair one, and who knows that Harry Hicken will not some day become an artist of repute? If the hands and feet are out of proportion, and the fingers too many, the pose of the body is fairly well depicted. The expression, too, is pretty good—indeed, excellent—for a child of seven.

The same idea is acted upon in the other classrooms, but the pictures, etc., are preserved in folios. These are specially made to hang on the walls, and they can be taken down and used at a moment's notice.

Drawing.

Such drawing as the Japanese doll is entirely outside the syllabus, which only shows these features—ruled and free-hand drawing, brush-drawing, and a *little* drawing from nature.

The head-mistress and one of the assistant mistresses are devoted to this subject to a marked degree, and as a consequence it is done exceedingly well. The freehand is particularly good, especially when one remembers that squared paper, such as is common in most infants' departments, is entirely discarded. The mistress does not believe in affording too much help to the children. "Let them learn to rely on themselves" is her motto. She thinks that the use of squared paper tends to the production of cramped work. She likes the bold line, and in most cases gets it. On the morning that this visit was made she was particularly pleased to show the writer the opinion of an eminent London doctor on cramped work, which in every way coincided with her own. On a piece of cardboard hanging up in the private room is a cutting from a London newspaper. It is part of a speech made by Professor Hardy of King's College Hospital. It reads:—

> "I believe that the present kindergarten system is at the root of much of the injury caused to young children's eyes. I have closely studied this phase of the question, and am able to speak from my own experience. The continuous concentration of young eyes on coloured paper, and on the small objects used in infants' schools, does, I am convinced, tend to provoke short sight in a few years. This mischievous element can be detected not only in London, but in all large towns where young children are forced, quite unconsciously, to strain their eyes in one direction in a strong light. I have warned the School Board in London that, unless some of these matters of which I have spoken are remedied, our hospitals will continue to deal with an ever-increasing supply of eye troubles."

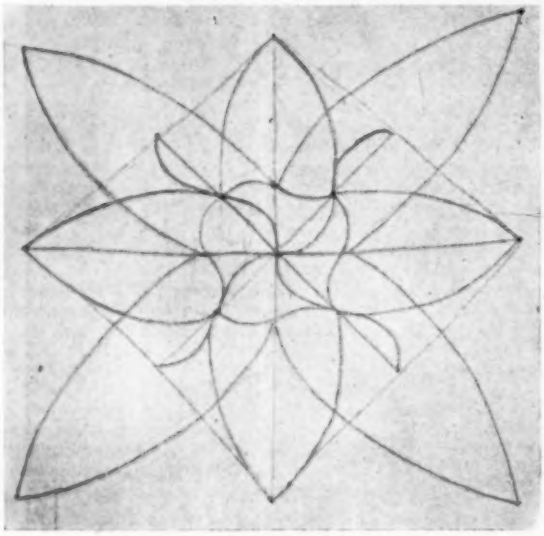
To be backed up in her opinions by so eminent an authority as Professor Hardy is quite a triumph for her.

Training of Teachers.

Leaving the classroom, and coming again into the main school, one is struck at once by the splendid management of the classes by the pupil teachers. Lessons have been changed, and one of the teachers is giving an object lesson to the whole group, while the other two teachers are taking notes. These will be compared by-and-by, and talked over with the head-mistress.

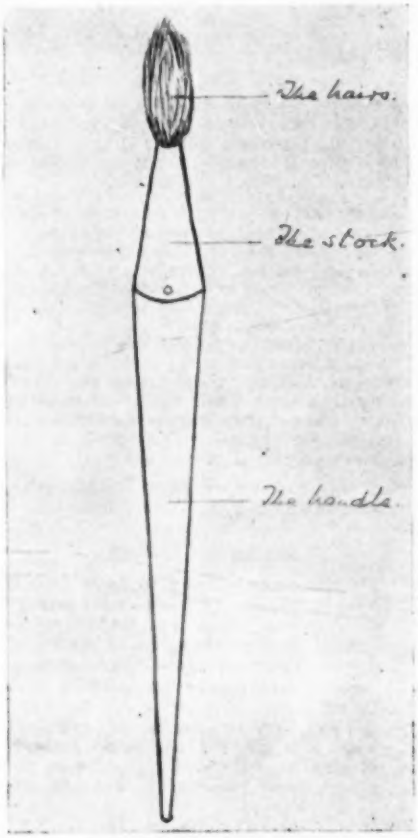
The young ladies may think it is very irksome to have to submit to so much criticism, but in the future they will bless the day they were apprenticed under so thorough a mistress. They cannot help being successful under her

training. Three prepared, or rather *specially* prepared, lessons are given each month. One of these is by the headmistress herself, and two others by two of the pupil teachers in turn. The pupil teacher who does not specially prepare a lesson in a particular month has a task of quite another



FREEHAND—NO RULING OR MEASURING.

nature. She *repeats* one of the lessons she has heard, and she is allowed to take her choice. The following notes on a lesson already given, and awaiting repetition, will show what is meant.



BLACKBOARD SKETCH OF BRUSH.

MODEL LESSON ON BRUSH-DRAWING.

NOTE.—The children are about to be started on a course of Brush-drawing. At present they have only seen specimens which have been done by the higher class. The aim of this lesson is to teach something about the *brush* the children will use.

INTRODUCTION.	1.	Teacher told children story of a house which looked very dirty. She asked them what would make it look fresh, and bright, and clean. Children answered that painting it would clean it. Teacher accepted answer, and asked for the names of the things the painter would use. Many names were given. She said the children should have a talk on the **brush**. In order to make the teaching real, a brush was given to each child.
PARTS OF BRUSH.	2.	Teacher made it clear that the brush the painter would use was not the same size as the one she had given the children. The painter's was much larger. But as the children were going to learn to paint, they should be taught to know as much about the brush as the painter knew.
(1.) The handle.		Teacher held a brush in her hand and told children to point to the part of the brush *she* pointed to. She then asked them where that part of the brush would be when the brush was being used. The teacher had pointed to the **handle**, and every child said, "In the hand." Teacher asked what would be a good name to give that part of the brush. Answer: Handle. Each child repeated the word, and it was written on the blackboard.
(2.) The hairs.		Teacher now asked the children to point to a part of the brush which was very soft, and nice to feel. They pointed to the hairy end, and some of them stroked their face with it. (Children are very fond of doing such things as this.) Teacher asked Mary Binks to try to pull the hairs out of the brush. She could not. Teacher then asked why the hairs were put in so tightly. Then as to the colour: Had the children ever before seen hair that colour? Yes, they had. Where? teacher asked. Their own, cats' hair, and dogs' hair. These answers were by different children. Could any child tell whose hair it was in the brush? Many guessed, but none knew for certain. Teacher then told them it was the hair of the camel. She also told them that because of this the brushes were called camel's-hair brushes.
(3.) The stock.		The children — and especially Mary Binks — were reminded that the hairs were fastened firmly to the handle, and could not be drawn out. The name of the fastener must be known, for it would often be used in the painting lesson. Teacher knew that no child could name it, so she told them straight off that it was called the **stock**. She asked what it was made of. Tin. It shone very brightly. Children told teacher this. Teacher asked if any girl could tell her why tin was used. Answer: Because it could be easily bent round.
RECAPITULATION.	3.	The brushes were now examined. It was noticed how nice and clean they were: black handles, shiny stock, and glossy hair. The children must always try to keep the pretty brushes clean, and do pretty work with them. Brushes were put down, and teacher drew a sketch of the brush on the blackboard. She asked for the names of the parts, and as they were given she wrote the names at the side of the sketch. Then the children picked up their brushes, and as teacher pointed to the handle in the sketch the children pointed to the handle of the real brush, and so on with *stock* and *hairs*.

Teacher's Opinion of Lesson.—The children found a talk on the brush very interesting. It will help them very much when they get to practical work. Indeed, the children wanted to use them immediately.

BRUSH DRAWING FROM COPY.

Head-Teacher's Note.—I think you followed the teaching very nicely, and I feel that it *was* a *very* useful lesson; also that you recognised this by your last remark.
Mark.—Very good.

With the head-mistress all must agree that the lesson had been followed very carefully, and that it quite earned the mark given to it. A teacher who in her young days can reproduce a lesson like this, and repeat it for criticism, is likely to become a valuable help in any school, and in the future a painstaking and capable head-mistress.
The training is excellent.

Object Teaching.

The list of object lessons could hardly be improved upon. Considering the locality of the school, they are admirable in every way. The babies have a museum all to themselves in their own room—that next to Standard I. It contains play-things too, such as a doll's tea-service, twenty or thirty tops, and a quantity of string, boxes of bricks, and many other things.
This is their present scheme of lessons:—

A. Animal Life.
  1. *Home.*—Cat, dog, rabbit.
  2. *Field.*—Fox, hare.
  3. *Abroad.*—Lion, tiger, elephant, rhinoceros, crocodile.
B. Animal Productions.
  An egg, milk, butter, cheese, leather.
C. Nature.
  A leaf, a flower, a plant.
  Seeds.—1. Where to find them in the plant (*specimens:* bean, pea, poppy).
  2. How sown by hand.
  3. How scattered by Nature.
  Roots.
D. Natural Productions.
  Orange, fig, cotton, flax, cocoa, tea, hops, coal, and iron.

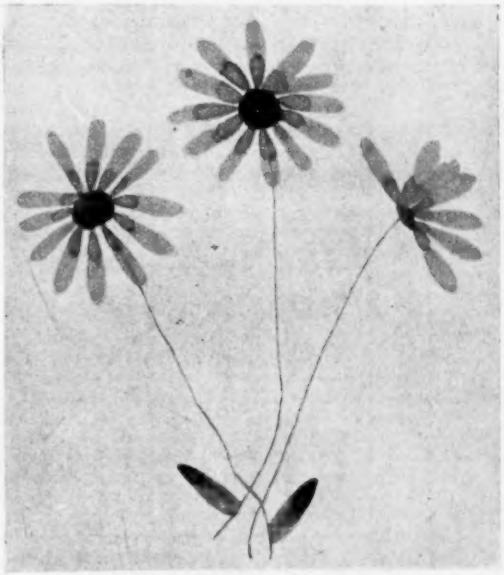
The scheme for the middle division is as follows:—

A. Animal Life.
  The horse, donkey, cow, sheep, pig, goat. The butterfly and the moth. The silkworm and the garden worm. The whale.
B. Animal Productions.
  Feathers, milk, and whalebone.
C. Nature.
  A plant, a flower.
  Special study of the buttercup, the daisy, and the dandelion.
D. Natural Productions.
  Coal, iron, salt, india-rubber, sponge, tea, coffee, cocoa, cotton, flax, wheat. Wood (*specimens:* oak, ebony, and pine).

Scheme for Standard I.:—

A. General.
  Weighing—the ounce and the pound. The school slate, the lead pencil, the india-rubber, soap, and the candle flame.
  The carpenter's tools—plane, chisel, saw, hammer, and the spirit-level.
  The blacksmith's tools—the hammer, the tongs, and the anvil.
  The miner.
    1. *Where* he works (description of a pit).
    2. *How* he works (tools, lamp, etc.).
    3. The engine-house, chain, and the cage.
  The shoemaker—his tools and his materials.
  The anchor and its cable.
B. Nature Study (in season).
  Water—its three states.
  The air—pure and impure.
  Resources of the district—coal, iron, lime, rocks.
  Examination of ores *not* found in the district—copper, tin, gold.
  Things we eat.
  Things we drink.

The museum in the main school is remarkably well fitted, and every lesson in the schemes (with the exception of such lessons as the rhinoceros, crocodile, etc.) can be illustrated from its shelves. The nature of the district suggests most of the lessons, and the children themselves have from time to time supplied the specimens. The miner's pick and the Davy lamp have both survived a colliery explosion, and the miniature anchor with its cable has been supplied by one of the managers, who is a manufacturer of some repute in that line. What the children have not been able to get have been procured from Messrs. A. Brown and Sons of Hull, and the purchase money, which was not very great, obtained from the proceeds of concerts, etc. There are several cases of other specimens on brackets on the school wall. These



BRUSH DRAWING FROM COPY.

have been supplied by the manufacturers of the articles they contain, and this very willingly.
There is, in addition, a very complete and extensive school library.

TIME-TABLE.

MORNING.

Class.	9 to 9.45.	9.45 to 10.	10 to 10.30.	10.30 to 10.45.	10.45 to 11.20.	11.20 to 11.55.	11.55 to 12.
Standard.	ASSEMBLY, REGISTRATION, PRAYERS, AND SCRIPTURE. EARLY MARKS AT 9.5. REGISTERS CLOSED AT 9.45.	Recitation.	Arithmetic.	PLAYTIME.	Reading.	Transcription.	DRESS AND DISMISSAL.
II.		,,	,,		Transcription.	Reading.	
III.		,,	,,		,,	,,	
IV.		,,	,,		,,	,,	
Babies.		,,	,,		Reading.	Transcription.	
Standard.			Arithmetic.		Transcription.	Reading.	
II.		Scale Singing	,,		Reading.	Transcription.	
III.		and	,,		,,	,,	
IV.		Voice Exercises.	,,		,,	,,	
Babies.			,,		Transcription.	Reading.	
Standard.		Recitation.	Arithmetic.		Reading.	Transcription.	
II.		,,	,,		Transcription.	Reading.	
III.		,,	,,		,,	,,	
IV.		,,	,,		,,	,,	
Babies.		,,	,,		Reading.	Transcription.	
Standard.			Arithmetic.		Transcription.	Reading.	
II.		Scale Singing	,,		Reading.	Transcription.	
III.		and	,,		,,	,,	
IV.		Voice Exercises.	,,		,,	,,	
Babies.			,,		Transcription.	Reading.	
Standard.		Recitation.	Arithmetic.		Reading.	Transcription.	
II.		,,	,,		Transcription.	Reading.	
III.		,,	,,		,,	,,	
IV.		,,	,,		,,	,,	
Babies.		,,	,,		Reading.	Transcription.	

AFTERNOON.

Day.	2 to 2.15.	2.15 to 2.20.	2.20 to 3.	3 to 3.30.	3.30 to 3.40.	3.40 to 3.55.	3.55 to 4.20.	4.20 to 4.25.
MONDAY.	Tables.	REGISTERS MARKED AND CLOSED.	Object Lesson.	Brush Drawing.	PLAYTIME.	Recitation.	Conversation.	DRESS AND DISMISSAL.
	,,		,,	,,		Reading.	Writing.	
	,,		,,	,,		,,	,,	
	,,		,,	,,		,,	,,	
	,,		,,	,,		Recitation.	Conversation.	
TUESDAY.	Tables.		Kindergarten.			Reading.	Singing.	
	,,					,,	,,	
	,,					,,	,,	
	,,					,,	,,	
	,,					,,	,,	
WEDNESDAY.	Tables.		Boys—Drawing. Girls—Needlework.			Reading.	Singing.	
	,,					Recitation.	,,	
	,,					,,	,,	
	,,					,,	,,	
	,,					Reading.	,,	
THURSDAY.	Tables.		Boys—Drawing. Girls—Needlework.			Reading.	Drill.	
	,,					,,	,,	
	,,					,,	,,	
	,,					,,	,,	
	,,					,,	,,	
FRIDAY.	Tables.		Drill.	Object Lesson.		Varied Lesson.		
	,,		,,	,,				
	,,		,,	,,				
	,,		,,	,,				
	,,		,,	,,				

NOTES.—Recitation at 9.45 is intended for simultaneous work, all classes learning the same pieces.
All children march from playground into main school for repetition of tables at two o'clock.
Varied lessons on Friday afternoons include (1) stories by teachers and children, (2) indoor arranged games (girls may bring their dolls), (3) peeps into books, (4) peeps into museum.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

NEW SCHOLARSHIP COURSE FOR 1903.

First Month—January.

AS we commence this month a new course for the King's Scholarship Examination of 1903, it will perhaps be necessary to explain to students the objects and scope of the course. It is primarily intended for those students who, working to a great extent by themselves, have not the advantages of good centre teaching, and consequently are at a great disadvantage in the preparation of their work. The solitary student inevitably meets with difficulties which puzzle him and delay his progress; he very probably misuses his time through not dividing it in due proportion between the various subjects; he cannot know how he stands with regard to other pupil teachers; and if he is at all earnest, there must be many occasions when he feels the necessity for some guidance and assistance. This course is planned, as far as possible, to meet all these points. The work is divided into monthly portions, to ensure regular and systematic work; notes are given on the more important points; a set of test questions is given, which are corrected at a merely nominal charge to regular readers; and any student may submit specimen essays, drawings, penmanship, etc., which are marked gratis. In the case of any difficulty not dealt with in the course, the student may write directly for assistance, which will be readily given.

Preparation for the Examination.

To the pupil teacher who has worked fairly well in the earlier years of his apprenticeship the Scholarship Examination should present no difficulty, and there is absolutely no reason why he should not obtain a first class. The reason why there are so many third classes and failures is not generally due to lack of ability, but to lack of good management. The student is bewildered at the number of subjects and their scope; he works spasmodically, nibbles a little here and a little there, devotes much time to what is useless and ignores what is really important, and arrives at the end of the year with a hazy, indefinite idea of many things, and an exact, detailed knowledge of nothing. To learn accurately and think clearly is the secret of success. Genius has been defined as the capacity for taking infinite pains, and this is undoubtedly true with regard to this examination. It is the candidate who works steadily on, week by week and month by month, learning everything thoroughly, allowing no difficulty to pass unsolved, arranging and digesting his knowledge, that inevitably secures a high position.

Every student must draw up a time-table for his private study, allotting as much time as he can spare to each subject in proportion to its importance. He must not attempt too much; it is useless to arrange for six hours' study when only three can be done. The health must be maintained by fresh air exercise, for health is a most important factor in success. On an average, three hours' study is as much as should be attempted, but it must always be remembered that by "work" is meant the hardest work possible. A student may sit with open books for four hours, while the mind wanders far afield or becomes hypnotised in a kind of trance, and the net result of the time spent is practically nothing. In study the mind must be alert, keen, and concentrated on the subject before it.

Having drawn up a suitable time-table, it must be rigidly adhered to. The weekly and monthly sections of the work must be done, otherwise arrears accumulate so rapidly that the whole scheme of work is disorganised.

Answer the Test Questions regularly and without reference to text-books; the marked answers will show whether the work has been properly prepared. Regular practice in writing answers is most essential, and it is obviously useless to write answers without having them properly corrected.

There is another point in connection with the examination which students who have any ambition should notice. The syllabus covers, to a great extent, the syllabus for the Matriculation Examination of the London University, and there is no reason why every student who can pass the Scholarship with credit next Christmas should not take the Matriculation Examination the following summer.

It is absolutely necessary for success that the candidate should possess good up-to-date text-books. We give below some advice on this point, and further advice as to the preparation of each subject.

Syllabus and Text-Books.

(*The syllabus may be obtained gratis on application to the Secretary, Board of Education, Whitehall, S. W.*)

1. *Reading.—To read with clear enunciation, ease, and intelligence from a work of a standard prose author and of a standard poet.*

This is a very much neglected subject, and as a result it is not surprising that comparatively few young teachers can read well. The reason is that very little *oral* practice is taken. It is one thing to read with the eye, and something entirely different to produce sounds with the voice. The Circular issued on this subject by the Board of Education should be carefully noted. Many pupil teachers also think that merely *saying* words is reading. It is not so; the voice must indicate, by modulation and inflection, that the reader grasps the meaning of the passage read.

Students will naturally select *Esmond* or *The Heroes* for their prose work, and *As You Like It* and *The Task* for their poetry. (Books recommended below.)

In addition to the special books, all candidates will find time to read many other standard books during the year. A special note on this will be given next month.

2. *Repetition.—To repeat one hundred lines of Shakespeare, or some other standard English author, with clearness and force, and knowledge of the meaning.*

The remarks on reading apply with equal force to this subject. The passage selected should either be the commencement of the *Winter Morning Walk* or *As You Like It*, Act II., Scenes i. and ii., or Act II., Scene vi., from "Why, how now, monsieur! what a life is this!" down to "Sans teeth, sans eyes, sans taste, sans everything." The last passage is more than the minimum number of lines, but the extra amount learned is well worth the effort.

3. *Teaching.*—(1.) *To teach a class in the presence of H.M. Inspector.* (2.) *There will be no separate paper on the theory of teaching, but candidates will be required to answer questions on the method of teaching any of the school subjects.*

This subject must not be left to chance, but needs careful preparation. Candidates must show some knowledge of the theory of teaching. Text-book: *Scholarship School Management*, eighth edition (Messrs. T. Nelson and Sons). This book has been specially prepared for the examination.

4. *Drawing.—Freehand drawing in outline.*

Candidates are required to make a drawing in outline on a half imperial sheet of paper (that is, 15" × 22") from photographic representations of casts of ornament, or models of foliage, fruit, etc., or natural foliage, fruit. At the examination pencil may be used for the guiding or preparatory work of the drawing, *which must be finished with a brush or pen outline.* The words underlined contain a new condition, which should be noted. Students are advised to practise with a brush and sepia, as with them a softer, smoother line may be obtained. Note also the size—small copies are useless. There is no lack of suitable copies, sets of which are published by Messrs. T. Nelson and Sons (2s. 6d.), Messrs. Blackie (four books at 1s. 6d. each), Macmillan's *Art Studies* (6d.—will do for an introduction), The Arts Company, Derby (four excellent sets at 2s. 6d. each).

5. *Music.*—The syllabus is practically unchanged—translation from one notation to another being added. Each candidate should endeavour to pass the examination for the School

Teacher's Certificate, the text-book for which is *The School Music Teacher*.

The practical part must not be neglected. *Music for Pupil Teachers*, 2s. 6d. (Messrs. T. Nelson and Sons), contains all that is necessary.

6. *Needlework.*—Girl candidates will find no difficulty in this. If a good book is required, *Needlework, Knitting, and Cutting Out*, by E. Rosevear (Macmillan and Co., 6s.), or *Manual of Needlework and Cutting Out*, by A. Walker (Blackie and Son, 5s.), is strongly recommended.

7. *Penmanship.—To set copies in large and small hand.*

This is always a weak subject although it is extremely simple, and involves but the learning of some half-dozen strokes and curves. Continual care and the application of a few definite rules enable any one to become a good writer. Use the *Practical Teacher Copy-Book*, specially prepared for this examination, and containing enough material for a year's practice.

Students should always use the same pen. Get a sample box of Brandauer's pens and select one suitable. They are excellent.

8. *Writing from Dictation.*—This requires occasional tests. If the candidate can spell correctly the words in *Words Commonly Misspelt*, Series A, B, and C (1d. each, Dawson and Co.), he will not be likely to be confronted with an unknown difficulty.

9. *Composition.—To write a short essay upon a given subject.*

Composition needs endless care and thought. It is one of those subjects where the student is apt to become disheartened, because there is no apparent result, no measurable advance. There is no simple formula by which a good essay can be written. Success depends upon two points—(*a*) a knowledge of a sufficient number of facts; (*b*) the ability to express them in good language; and both of these depend upon wide, careful reading and clear thought. There are many books on the subject, the best of which is Meiklejohn's *Art of Writing English* (Holden), but the study of any book alone is of little use. Continued effort is necessary, and the candidate must write an essay of from thirty to forty lines at least once a week. The subject should be studied and an analysis made before commencing to write, or there will be useless repetition and much confusion. *One Hundred Essays in Outline* (A. M. Holden) gives good examples of this mapping out. Essays should be regularly sent in for criticism.

10. *English Language and Literature.*

For grammar, the student should use *The Pupil Teacher's English Notebook* (Nelson) for a base. It is not sufficient in itself, but there is nothing in it which should not be thoroughly known.

Nesfield's *Manual of Grammar and Composition*, 2s. 6d. (Macmillan), *The English Language*, by W. H. Low, 3s. 6d. (University Correspondence College), *English Grammar*, by Mason, 3s. 6d. (George Bell and Sons), are amongst the very best text-books on the subject.

For a general history of the language and literature we recommend *The Tutorial History of English Literature* (University Tutorial Press, 2s. 6d.), *Great Authors* (T. Nelson and Sons), Brooke's *English Literature* (Macmillan's Primers), M'William's *English Literature* (Longmans).

Special Books.

(1.) *As You Like It.* There are many editions of this play, many of them excellent. Moffatt's edition (E. J. Arnold and Son), 2s., may be highly recommended. Messrs. Blackie publish it in the Warwick Shakespeare series, and also with fine illustrations in the Picture Shakespeare; Messrs. Longmans in the Swan edition. Messrs. Macmillan have a very good edition at 1s. 9d., and Messrs. Chambers at 1s. Messrs. Allman and Son have issued a book of questions on the play, which include every possible topic.

(2.) Cowper's *Task*, Book V. Messrs. Ralph, Holland, and Co.'s interleaved edition, together with Macmillan's edition.

(3.) Cowper's *Expostulation*. The edition by Messrs. T. Nelson and Sons is the best. It contains everything in the way of general information, and notes, paraphrases, hints on parsing and analysis. Editions are also issued by Messrs. Ralph, Holland, and Co., Messrs. Macmillan and Co., etc.

(4.) Thackeray's *Esmond*. Students should procure the volume in the New Century Library, 2s. (Messrs. T. Nelson and Sons), beautifully printed on thin paper. Such notes and criticisms as are necessary will appear in these columns.

(5.) Kingsley's *Heroes*. Use Macmillan's annotated edition, 1s. 6d. Where possible, students should get more than one book on a subject; the views of different editors are always very helpful.

11. *Geography.—The World, with special reference to the British Isles and the Colonies.* This subject requires much time and care. If the work has been thoroughly done during apprenticeship, it is not so formidable; but if not, it will entail persistent effort throughout the year. The enormous number of facts will become confusing unless they are carefully analysed and impressed upon the memory largely by the drawing of maps. The Board of Education have very wisely abandoned the setting of special maps for preparation, and require that sketch-maps should be drawn to illustrate every answer. In fact, it is always a safe means of testing knowledge on the subject; the geography is not known unless the student can draw a fairly accurate and full map from memory. Of text-books there is a bewildering variety—Meiklejohn's *Comparative Geography*, Brook's (Nelson), Mill's (Macmillan), being among the best. For the colonies we recommend *British Colonies* (6d., Holden) for groundwork, *The Building of the British Empire* (2s., Holden) for history, and Gill's *British Colonies* (2s. 6d.) for more detailed study. Phillips publish a little book which contains excellent accounts of the leading industries. In addition to these, all students should get from the agents for the colonies some of the excellent illustrated handbooks, which are issued gratis, and contain invaluable information. A whole library of colonial geography and history may be had for the asking.

A good atlas is a *sine qud non*. Holden's (2s. 6d.) is reliable. Phillips publish a neat atlas of the colonies. Any up-to-date atlas will do. To see how a sketch-map should be drawn, get *Methodic Memory Maps* (T. Nelson and Sons, 1s.).

12. *History.—Outlines of English History from the Roman Invasion to 1870.*

This is another very wide subject which demands very careful preparation. The greatest defect in all history papers is a haziness of ideas and a lack of clear, definite facts. This arises from reading the subject instead of learning it. A careful analysis must be made and committed to memory, as a self-made analysis is much better and a greater help to the memory than those drawn up by other people. Having thoroughly learned the substance of a reign or period, then read as much as possible on it from any books.

The historical novel plays an important part in the preparation of the subject: for example, Lytton's *Harold*, Kingsley's *Hereward*, Scott's *Talisman*, Lytton's *Last of the Barons*, Scott's *Kenilworth*, Kingsley's *Westward Ho!* etc., etc., present pictures of life and manners which can hardly be forgotten. With every event the student should ask himself the questions, What causes brought this about? and What results accrued from it? The habit of mental analysis and the proper connection of ideas is of great advantage in dealing with such a multitude of facts as this subject presents.

With regard to a text-book, we recommend Meiklejohn's *History of England*, Green's *Short History* (Macmillan), Gardiner's *Student's History* (Longmans), Airy's *English History* (Longmans). Ross's *Manual of English History* may be read with advantage. If time permits, there are many excellent biographies which may be read with advantage; and if special information is required on any point, there is no lack of suitable books.

Each student should also possess a good historical atlas—for example, Gardiner's, published by Longmans at 5s.

If an analysis is needed, Will's *Synopsis* (Blackie), Gill's *Synopsis*, or Pearce and Hague (Murby) may be obtained.

13. *Arithmetic.*—By far the best book for the examination is Christian and Collar's *New Arithmetic* (Holden). Specially prepared by teachers for teachers, it is naturally more suitable than a book which does not deal with the subject from a pedagogic standpoint.

14. *Algebra.—Up to ratio and proportion.*

The text-book recommended is Hall and Knight's *Elementary Algebra* (Macmillan).

15. *Euclid.*—Hall and Stevens's *Euclid* (Macmillan), or any standard book. For deductions, Egan's *Exercises on Books I. and II.* is the best collection we know.

16. *A Language.*—My advice is frequently asked as to whether a student should take up a language for the examination. Whether this is advisable or not depends upon the ability of the candidate and the time at his disposal. If he is not strong in other subjects, it is *not* a wise thing to do, since the language will be inadequately done; and as candidates who obtain less than 25 per cent. are not credited with marks at all, it is quite possible that all the time devoted to the language has been thrown away as far as the examination is concerned. If, however, a student can spare a good deal of time, there is no reason why he should not acquit himself creditably in French.

17. *Elementary Science.*—There is a very detailed syllabus given in this subject. Section I. is what has been done in apprenticeship. Section II. is divided into A, B, C, of which the student may take one. Probably B (elementary astronomy) will be the easiest for the self-taught student. Section A (elementary chemistry) is much easier for those who have access to a class. The student working alone can prepare the subject

satisfactorily. Most of the experiments can be worked with apparatus costing only a few pence. Cartwright's "*Section One*" *Physiography* (Nelson) covers Section I., and Longmans' *Section II. Physiography* deals adequately with the astronomical part of the syllabus.

18. *General Information.*—The preparation of this subject is naturally a problem of considerable perplexity to the student. There is no text-book on it, for obvious reasons; a student's success in it will depend upon his general reading. Some of the most salient points have been dealt with in these columns last year, and we shall, as in the past, set a paper each month on the subject, which will indicate to some extent the scope of the examination. Such a book as Brewer's *Dictionary of Phrase and Fable* (Cassell, 7s. 6d.) is a most useful companion, but no book will help the student who is not of an inquiring turn of mind. Let nothing pass you that you do not understand; if you cannot find out the meaning, you are cordially invited to write for assistance, which will be given either in these columns or by letter. A year's persistent search for knowledge is bound to bring its own reward. Messrs. Macmillan publish a book of *Test Papers* on the subject, and also a key. A similar book is issued by Messrs. E. J. Arnold.

In addition to text-books on special subjects, every student should obtain Whitaker's *Almanac* (2s. 6d. edition) for accurate and up-to-date information. A good dictionary should always be at hand; Chambers's *Twentieth Century Dictionary* is a marvel of cheapness. The earnest student will also find many paragraphs and articles in the newspapers which will help him. These should be cut out, and pasted in a book and carefully indexed.

Work for the Month.

1. *Reading and Repetition.*—Ten minutes' oral practice per day should at least be taken.

2. *Teaching.*—Chap. i., *Scholarship School Management.*

Every effort should be made to master the contents of this chapter—namely, the elementary principles of psychology—for upon a knowledge of it depends nearly all success in teaching. No one can educate the mind who does not know what the mind is and how its faculties are developed. It is the entire ignorance of psychology which leads to so much wasted time in school, and to so much useless repetition. If you cannot follow any part, write for explanation, but try your hardest to grasp the essential facts.

3. *Drawing.*—Do one or two copies each week, and send them up for criticism. If you look carefully at any copy, you will see that it is built up on a few simple curves; unless you can recognise these, you will invariably go wrong. When you have found them, draw them in due proportion, and do not attempt any detail till this is correctly done. Having sketched the whole of it, line in with a fine brush and sepia, making the chief lines a little bolder than the others. Aim especially at freedom of movement. A curve drawn with a free sweep of the hand is always better than one done in little pieces.

4. *Music.*—The major and minor modes, bridge notes and first removes of key. This is merely revision work, and should occupy but little time.

5. *Penmanship.*—Ten minutes' practice per day in the *Practical Teacher Copy Book*, and continual care.

6. *Composition.*—Write one or two essays each week on such subjects as—

(*a*) My Favourite Book.
(*b*) Newspapers.
(*c*) The Different Characters of Children.
(*d*) "A bird in the hand is worth two in the bush."
(*e*) The English Character.
(*f*) The Government of England.
(*g*) Christmas.

Note particularly what is said above on this subject. Read the subject up, if necessary, make out a preliminary plan, write your essay roughly, and then go over it and polish the sentences and expressions into the best English at your command. If you keep a separate well-bound exercise book for this subject, you will find it a very useful book in after time.

Suppose you are dealing with (*d*), "A bird in the hand is worth two in the bush." You might start by explaining that it is a proverb—"the wisdom of many and the wit of one;" that it contains a truth which many have recognised, but that some one has expressed in appropriate words that live. Every proverb has (*a*) a literal meaning, and (*b*) a general application. In this case the former is apparent; the latter is, that it is better to hold to a certainty than to relinquish it on the chance of getting something better. Illustrate this meaning by reference to everyday experiences which must occur to you. Then you might discuss the truth of the phrase. It is contradicted by another well-known maxim, "Nothing venture, nothing have"—without enterprise and the running of risks there can be no advance. Conclude that the proper line of conduct lies somewhere between the two—no slavish adherence to custom or habit, and no rash experimenting with the unknown without due consideration.

7. *English.*—(1.) Learn twenty-five roots and meanings each week.

(2.) Prepare thoroughly the grammar and syntax of the noun, noting especially the methods of forming the feminine, cases where there are different words for the genders; methods of forming plurals, nouns with double plurals, no plural, no singular, false plurals; and the various cases—nominative, absolute, objective, direct, and indirect (cognate, factitive, reflexive, residual, etc.).

(3.) *The Task*, Book V., lines 1–40.

(4.) *As You Like It*, Act I., Scene i.

(5.) The history of the language up to 1066.

Before commencing the detailed study of the play, read up the introduction in order to obtain some idea of the principal *dramatis personæ*. Then read the play through, and endeavour to appreciate its beauty. This should not be a heavy task. It is so beautiful that it is difficult to tear oneself away from it, and the more it is read the more attractive it becomes. Regard it from the first as something to be admired and enjoyed, and not as a tedious exercise in parsing, analysis, and the preparation of dry notes. Carry a little pocket edition about with you, and read it at any odd moment until you can locate any line and who said it. Any difficulty will be explained if students will send it up.

For the notebook.—The languages of Europe.

Nearly all the languages of Europe are derived from the Aryan language, spoken by a people inhabiting the centre of Asia. As successive waves of migration relieved the pressure of overpopulation in this district, different dialects were formed, which being enriched by additional words, as new ideas occurred, developed into different languages, but the roots of many words common to all of them show their common origin. The different languages and their interrelation is shown in the following table:—

- Aryan
  - 1. Hindu—Sanskrit (dead), Hindustani, Bengali, Cingalese, etc.
  - 2. Iranic—Persian.
  - 3. Keltic
    - Irish, Gaelic.
    - Welsh, Manx.
    - Armorican (in Brittany).
  - 4. Romance
    - Latin, Italian, French, Spanish, Portuguese, Wallachian.
  - 5. Hellenic—Ancient and Modern Greek.
  - 6. Teutonic
    - Low German—Anglo-Saxon, English, Dutch, Frisian, and Flemish.
    - Scandinavian—Icelandic, Danish, Norwegian, Swedish.
    - High German—Modern German.
  - 7. Slavonic—Russian, Polish, Bohemian.

From this it will be seen that the Anglo Saxon and English belong to the Low German section of the Teutonic branch, having as their nearest relatives Dutch, Flemish, and Frisian.

The Celtic language spoken by the Britons was swept away by the Saxons, the only remaining traces being (*a*) a few words retained by the women whom the Saxons conquered and made their wives—for example, mop, crock, clout, etc.; (*b*) geographical names—pen, aber, caer, etc. Of the many Roman words adopted during the Roman occupation very few remain—*colonia*, a colony (Lincoln); *strata*, a street (Stratford); *portus*, a harbour (Portsmouth); *castra*, a camp (Chester, Lancaster, etc.); *fossa*, a ditch (Fossway); *vallum*, a wall (Wallsend).

The Anglo-Saxon language was highly inflected, and formed new words largely by compounding.

Of Anglo-Saxon literature the chief examples are:—

The Beowulf, The Song of Brunanburgh, The Anglo-Saxon Chronicle, The Paraphrase of Caedmon.

The poetry was alliterative; it had no rhyme, but a certain number of words had to commence with the same letter.

General Reading.—The Heroes: Story I., Perseus.

Pay particular attention to the correct pronunciation of the Greek names.

8. *Geography.*—(*a*) British possessions in Europe and Asia (excluding India).

(*b*) Revise Europe generally—France, Spain, Portugal.

Note very carefully the remarks on preparing this subject

above. Sketch-maps must be drawn for every colony and country, and all places inserted which are to be remembered.

In dealing with the colonies, learn exactly the different kinds of colonial government. The smaller possessions which come under this month's work are mainly used as depots for trade, shelters for shipping, and coaling-stations. The last are very important in these days of steamships. The use of a man-of-war is limited by the coal it can carry, and it would be manifestly impossible to maintain a fleet in the North Pacific if each vessel had to come home for supplies of coal, hence the necessity for coaling-stations at various points. Gibraltar, Malta, Aden, Singapore, Hong-Kong, etc., are therefore essential to our naval supremacy.

9. *History.*—From the Roman Conquest up to 1066.

In addition to the usual topics in a text-book, prepare answers to such questions as: Why did the Romans come? Explain their system of governing the island. Why did they leave? What were the results of their occupation? Trace the steps by which the various Saxon kingdoms became one. How was Christianity introduced (*a*) in the south; (*b*) in the north of England? Give some account of the Saxon religion. Compare and contrast the Roman, Saxon, and Danish invasions. What were Dunstan's aims, and how far was he successful in carrying them out? What intercourse had England with the Continent prior to 1066?

10. *Arithmetic.*—Revise the theory up to and including G.C.M. and L.C.M. Make sure that you can work all the questions in the text-book, and work Nos. 1-50, General Examples (Christian and Collar).

11. *Algebra.*—Factors. These are treated excellently in Hall and Knight. A test-paper will be set next month.

12. *Euclid.*—Revise I–10, Book I., with six deductions per week.

13. *Elementary Science.*—Prepare the first two sections in the syllabus. *Matter:* forms, indestructibility, mass, volume, specific gravity, centre of gravity, parallelogram of forces, composition and resolution of forces, change of rectilinear into circular motion.

14. *General Information.*—Look up (from a good dictionary) the meaning of common abbreviations, commonly used French and Latin phrases.

Test Questions in General Information.

The answers to these questions are marked gratis. They should be written on foolscap (one side only), the coupon of the current number must be enclosed, and a stamped addressed envelope should be sent if the answers are to be returned.

All papers should be sent direct to Mr. A. T. Flux, The Bays, Belvedere, Kent.

1. Give examples of migration of birds and animals, and explain the causes.

2. Write down the names of the ten best books you have read, and say approximately when the authors lived.

3. Fill up blanks in the following:—

(*a*) ...is human...divine.
(*b*) ...is the better part of valour.
(*c*) 'Tis distance lends...to the view.
(*d*) The...of...lead but to the grave.
(*e*) None but...deserve the fair.
(*f*) The cup that...but not...

4. Explain simply how a steam-engine works.

5. Why is a volcano sometimes in eruption and sometimes not?

6. Write a short life of any great man not connected with English history.

7. What is the best way of sending £5 from one part of England to another?

8. Distinguish between puerile and childish, reverend and reverent, continual and continuous, fame and notoriety, calender and calendar, electric and eclectic.

N.B.—I should be obliged if all those who intend to follow this course regularly would send me a card with their name and address. Special arrangements can be made with regard to marking their monthly test papers and giving them further assistance.

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1903.

1. *Reading and Repetition.*—Continue regular oral practice in these subjects.

2. *English.*—Ver. 29–32, Gray's *Elegy in a Country Churchyard.*

Ver. 29. "The next morning we saw him carried through the churchyard to his grave with the sound of funeral chants; and if you will go and read (for surely an educated man like you can read) the inscription on the stone beneath yonder aged thorn, you will see his epitaph."

Next. Adjective, ordinal, limiting *morning* understood.

Borne. Perfect participle, qualifying *him.*

Ver. 30. "Under this stone is resting one who was unknown to Fortune and Fame. Though of lowly birth, he nevertheless made some considerable progress in learning; yet his whole life was tinged with an incurable sadness."

Earth. Personified in this case as Mother Earth, who receives her tired children after the troubles of life.

Unknown. Adjective, qualifying *youth.*

Own is sometimes taken as a possessive pronoun. It is probably better to regard it as an adjective of emphasis, emphasising the possession. The only difference in meaning between *my book* and *my own book* is additional stress on the possession.

Ver. 31. "He was an honourable man, with a generous disposition; his poverty prevented him from giving much more than his sympathy to the poor; but Heaven rewarded his kindly thought by granting him the best of human blessing—a sincere friend."

Did. Not auxiliary of emphasis—merely used to make an alternative form of the past tense.

As. Adverb of degree, limiting *largely.*

All. Indefinite pronoun, direct object of *gave; tear,* in apposition: read *which he had.*

Ver. 32. "Seek no further to ascertain either his virtues or defects, but let them rest with him in the grave to which he has gone, in the humble hope that the Almighty Father will forgive whatever has been done amiss."

Analyse.—*Subject,* you; *predicate,* seek; *extension,* no further; *object,* to disclose his merits, to draw his frailties from their dread abode (where they alike in trembling hope repose)—the bosom of his Father and his God.

Note the infinitives forming the object.

3. *History.*—Charles the Second to Anne.

Read carefully all your text-book says, and note particularly the Clarendon Code of laws aimed at dissenters, the Great Fire and Great Plague, the Dutch War, the Declaration of Indulgence, and the trial of the bishops. The Declaration of Rights (afterwards Bill of Rights), which settled definitely the points over which kings and parliaments had been quarrelling for one hundred years. The new condition of affairs in William's reign (government by party, appropriation of supplies, national debt, etc.). Marlborough's campaigns (learn a plan of Blenheim). The union with Scotland.

4. *Geography.*—The physical features, climate, and productions of Ireland.

The following questions have been asked:—

(1.) Give an account of the mountain system of Ireland.
(2.) Describe the physical features of Ireland.
(3.) In what parts of Ireland are the raising of live stock and the manufacture of linen and woollen goods carried on? Account for these industries being localised.
(4.) Describe briefly the situation and character of the Bog of Allen, Connemara, Lakes of Killarney, Giants' Causeway, Valentia Island, and Cove of Cork.
(5.) Describe the west coast of Ireland.
(6.) Draw a sketch-map of Ireland, marking in the mountains, rivers, and lakes.
(7.) Make a list of the islands round Ireland. How do you account for there being more on the west than on the east?

5. *Arithmetic.*—Simple proportion, by proportion and method of unity.

6. *Euclid.*—Book I., Props. 22–26, with two deductions per week.

7. *Algebra.*—G.C.M. and L.C.M. of simple quantities.

8. *Elementary Science.*—The air-pump and its uses.

9. *Music.*—Revise generally.

Test Questions.

1. *Penmanship.*
Large hand—*Gray's Elegy.*
Small hand—*Stone walls do not a prison make,*
Nor iron bars a cage.

2. Analyse the following, and parse words in italics:—

"*There,* at the foot of *yonder* nodding beech
That wreathes its old fantastic roots *so high,*
His listless length at noontide *would* he *stretch,*
And *pore* upon the brook that babbles by."

3. Write out any verse from the *Elegy,* and scan the lines.

4. What do you understand by passive voice and subjunctive mood? Give examples from the poem if you can.

5. Explain as clearly as you can the causes which led to the Civil War.

6. Write three or four lines each about four of the following—Bacon, Strafford, Laud, Hampden, Monk.

7. Say what you can of the Trossachs, the Lothians, the Shetlands, Glenmore, Iona.

8. Describe the construction of the common barometer. Why is mercury used in preference to any other liquid?

9. (*a*) Find the value of $\left(\frac{3}{7}+\frac{5}{8}\right)$ of four guineas + (·09 − ·01) of £2, 1s. 3d. + (5·05 ÷ ·005) of 5s. Ans. £257, 2s. 2½d.

(*b*) Subtract $1\cdot32\dot{7}$ of 308 days for $1\cdot\dot{2}$ of a year, and express the result as the decimal of half a year. Ans. ·204.

(*c*) Add ·275 of a bushel to ·725 of a quarter, and find the value of the whole at 13s. 4d. per bushel. Ans. £4, 1s. 0d.

(*d*) Find by decimals the rent of 89 acres 1 rood 30 perches of land at £2, 17s. 6d. per acre. Ans. £257, 2s. 7·875d.

First and Second Years.

1. *Reading and Repetition.*—As much oral practice as possible.

2. *English: First Year.*—Cowper's *Task*, Book V., lines 272–304, *or* Cowper's *Expostulation*, lines 273–303.

Second Year.—Milton's *Paradise Lost*, Book III., lines 476–522, with knowledge of all meanings, allusions, etc.

Special Study.—(*a*) The adverb. Classification, comparison, etc.

(*b*) Palgrave's *Golden Treasury of Songs and Lyrics.*

Study Nos. 139, 140, 144.

139, 140. These short poems of Herrick are two of his finest lyrics.

144. Milton stands out entirely alone in his period. His works may be divided into (*a*) the earlier poems—*Ode on the Nativity, Lycidas, L'Allegro, Il Penseroso, Comus;* (*b*) his political works—for example, *Eikonoclastes, Defence of the People of England*, etc.; (*c*) *Paradise Lost, Paradise Regained*, and *Samson Agonistes.*

L'Allegro exhibits the views of the optimist, the man who looks on the bright side of things and finds "unreproved pleasures" in the song of the lark, the early dawn, the cheerful busy sounds of country life, the delights of the city, and the charms of lively music. The poem should be carefully read several times, and all the allusions looked up.

3. *History: First Year.*—Edward the Sixth, Mary, and Elizabeth.

Note the social discontent in Edward the Sixth's reign (Ket's rebellion, etc.), caused by the dissolution of the monasteries, and changes in agricultural methods. The Marian persecution was the one thing needed to confirm England in its Protestant faith.

The reign of Elizabeth is deserving of the closest study. The rise of England from a third-rate country to the first maritime power in Europe was the result of steady and persistent effort on the part of the queen and her advisers.

The solution of the many problems which faced her on her accession should be noted. The formation of an army and navy, the soothing of religious hatreds, the encouragement of commerce and manufacture, the poor laws, the plans by which France and Spain were prevented from invading England till it was strong enough to defy them, are important movements which should be closely followed.

Second Year.—Second-year pupil teachers should start at once and follow the Scholarship Course.

4. *Geography: First Year.*—The Malay peninsula, the East Indies, Afghanistan.

Second Year.—As in Scholarship.

5. *Arithmetic: First Year.*—Simple interest. To find principal, rate, and time. This must not be done by formula, but by such simple reasoning as children can readily follow. The method is fully explained in the text-book.

6. *Euclid: First Year.*—Props. 37–40, with two deductions each week.

Second Year.—Book III., Props. 1–6; and in addition, revise as set out in the Scholarship Course.

7. *Algebra: First Year.*—Chap. xii., Hall and Knight. Elementary Fractions.

Second Year.—Chaps. xxiii., xxiv. Harder Equations.

8. *Elementary Science.*—First Year should revise the year's work.

Second Year.—Follow what is prescribed in Scholarship Course.

Test Questions.

First Year.

1. Write an essay on Cowper and his work.

2. What is meant by comparison of adjectives? Give and explain instances of irregular comparison. What adjectives do not admit of comparison?

3. How do you account for the nearly absolute power exercised by the Tudors?

4. What were the chief points on which the Reformers differed from the Roman Catholic Church?

5. Give a full account of the productions of Siberia. What do you know of the Trans-Siberian Railway?

6. Say what you can of the advance made in recent years by the Japanese.

7. (*a*) A person selling apples at 3 for a penny gains 5 per cent. Find the loss or gain per cent. when 25 are sold for 6d. Ans. 24⅔ loss.

(*b*) A reduction of 20 per cent. in the price of apples would enable a purchaser to obtain 120 more for a sovereign. What may the price be before reduction? Ans. ½d.

(*c*) A tradesman sells ½ of his stock at a gain of 20 per cent., ⅓ at a gain of 12 per cent., and the remainder at a loss of 10 per cent. Find the average gain per cent. on the whole. Ans. 12⅓.

(*d*) A commission agent agrees to take 5 per cent. of all sales, or ⅓ of net profit. ·35 of his transactions realise 10½ per cent. profit, the remainder 19½ per cent. What would be the difference on sales of £600000, according as all his customers adopt one or other agreement? Ans. £2700.

8. If an object is placed close to one side of a looking-glass, state and explain what you would see on looking at it from any point from which you could see a complete reflection.

Second Year.

1. Write an essay on Milton's prose works.

2. As No. 2 above.

3. Correct the following sentences, giving reasons for each correction:—

(*a*) The effluvia was disgusting.

(*b*) Every man and boy showed their joy by clapping their hands.

(*c*) Are either of those pens yours?

(*d*) Having finished the chapter, the volume was shut.

(*e*) Hoping you are well, believe me yours truly.

(*f*) The Thames is derived from the Latin Thamesis.

4. Give an account of the Crimean War. Draw a sketch-map.

5. Mention two or three of the most important discoveries of the nineteenth century, and give an account of one.

6. What is meant exactly by the Commonwealth of Australia. How is it governed?

7. (*a*) What would be the expense of painting (at 3s. 2d. a yard) the walls of a room 27 ft. long, 17½ ft. broad, and 11½ ft. high, the dimensions of four windows being 7½ ft. by 4 ft. each? Ans. £15, 17s. 10½d.

(*b*) A floor is half as long again as it is broad, and contains 13824 sq. ft. Find the length of the shorter side, and the cost of flooring at 4½d. per sq. yd. Ans. 96 ft.; £28, 16s. 0d.

(*c*) £8, 11s. 0d. is spent upon the floor of a room 24 ft. long and 18 ft. wide. The centre of the room is covered with carpet 2 ft. wide, at 4s. 3d. per yard, leaving a margin of 3 ft. all round the carpet. How much per square foot does the margin cost to paint? Ans. 1d.

8. Which of the following is highest in pitch, and which lowest?—

l in key B♭, r in key G, l in key C, f, in key E♭, s in key F.

CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of THE PRACTICAL TEACHER (and *nom de plume* if desired), must be enclosed.

As a rule, all replies will appear in the Correspondence Column; but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

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LOGIC FOR L.L.A. AND LONDON MATRICULATION.

BY T. E. MARGERISON, M.A. (LOND.),
Principal of the Tottenham Pupil Teachers' Centre.

VI.

Mediate Inference.—So far we have been considering those forms of inference where the conclusion is drawn from a single premise. We now pass on to a much more fruitful process—*Mediate Inference*—in which the reasoning is based on more than one premise. Of this there are two forms, called *Inductive* and *Deductive*, according as the conclusion is or is not more general than the premises. The principles underlying the former of these are the subject-matter of Inductive Logic, while the rules of deductive mediate inference are set forth in the doctrine of the Syllogism.

The Syllogism.—This is the name given to the logical form of a mediate deductive inference. Its nature is illustrated by the following example:—

All coins are made of metal.
All pennies are coins.
∴ All pennies are made of metal.

It will be seen that there are three propositions, the last of which, called the *conclusion*, is inferred from the other two, called the *premises*, conjointly. An analysis of the propositions shows that there are also three terms, "coins," "made of metal," and "pennies," each occurring twice. The two terms of the last proposition are in the premises compared in turn and found to agree with the third term, and as a result of this comparison the statement of agreement between the two terms themselves, which forms the conclusion, is possible.

The term common to the two premises is called the *Middle Term*; while of the other two, that which forms the predicate of the conclusion is called the *Major Term*, and the subject of the conclusion is the *Minor Term*. The premise containing the Major and Middle Terms is known as the *Major Premise*; the proposition which contains the Minor and Middle Terms is called the *Minor Premise*.

The minor term or subject of the conclusion is usually expressed symbolically by S, the major term or predicate of the conclusion by P, and the middle term by M. The type of syllogism of which we have a concrete example above can therefore be expressed symbolically—

M is P (major premise).
S is M (minor premise).
∴ S is P (conclusion).

Aristotle regarded this kind of syllogism, where the middle term is the subject of the major and the predicate of the minor premise, as the perfect form. All other forms are reducible to this by applying processes of immediate inference to the premises, and he therefore enunciated the famous *Dictum de omni et nullo* (statement about all and none) as the fundamental principle of all syllogisms:—"Whatever is predicated of a term distributed, whether affirmatively or negatively, may be predicated in like manner of every term contained under it." Thus in the above syllogism "made of metal" is predicated of "coins;" therefore it can also be asserted of "pennies," which by the minor premise is predicated as contained under "coins." The *Dictum*, like the various syllogistic canons propounded by modern logicians, is really a fuller statement of the Laws of Contradiction and Identity as applied to the syllogism.

Rules of the Syllogism.—A perfect syllogism must conform to the following rules:—

1. It must contain three and only three terms.
2. It must contain three and only three propositions.
3. The middle term must be distributed in one at least of the premises.
4. No term must be distributed in the conclusion which was not distributed in one of the premises.
5. One premise at least must be affirmative, for from two negative premises nothing can be inferred.
6. If one premise be negative, the conclusion must be negative; and to prove a negative conclusion, one of the premises must be negative.

These rules are very important, and should be committed to memory. It will be noted that two relate to the structure of the syllogism, two to quantity, and two to quality.

The first two rules state the structure of the syllogism as already described. From the nature of the syllogism there must be *three* terms, in order to compare two by means of a third; and not more than three, for then we have either two syllogisms or no syllogism at all. Moreover, the inclusion of more than three terms requires that every term should be employed in the same sense throughout the syllogism, for a term used with two meanings is really two terms, making in all four terms. In the following example the absurd conclusion arises from the fact that the word "banks" has different meanings in the two premises, and is therefore two terms; there is thus no means of connecting the terms "sides of a river" and "having London agents."

All banks have London agents.
The sides of a river are banks.
∴ The sides of a river have London agents.

Ambiguity is most likely to arise in the middle term, and this fault is sometimes expressly forbidden by the addition of the words "and must not be ambiguous" to the third rule. The first rule, however, sufficiently guards against the error, so that the addition is unnecessary.

Rule 3 requires the distribution of the middle term at least once in the premises. Breach of this rule is known as *Undistributed Middle*, and is a very common fallacy. The following is an example:—

All dogs are animals.
All sheep are animals.
∴ All sheep are dogs.

Here the middle term is not distributed in either premise, being the predicate of an affirmative proposition. Part only of the denotation of "animals" is referred to in each proposition, and as the part with which "dogs" is connected is not the same as the part connected with "sheep," there is no ground for asserting agreement between "dogs" and "sheep." It is only by taking the middle term in its full denotation at least once that we can be sure of having that relating of the extremes in the middle term which is necessary for a conclusion, stating agreement or non-agreement between them.

Breach of Rule 4 is called *Illicit Process of the Major or Minor Term*, according to the term involved. Evidently if an assertion is not made in the premises about the whole of a class, we are not justified in making it of the whole of the class in the conclusion. Consider the following—

1. All books are subject to error.
   All books are of man's invention.
   ∴ All things of man's invention are subject to error.

2. All feathered animals are vertebrates.
   No reptiles are feathered animals.
   ∴ Some reptiles are not vertebrates.

In the first of these examples, "things of man's invention" is distributed in the conclusion; but in the premise, being the predicate of an affirmative proposition, it is not distributed; and since it is the minor term, we have *Illicit Process of the Minor*. This fallacy is very apparent, and it is therefore rare. But *Illicit Process of the Major* is more subtle, and consequently occurs more frequently. It is illustrated in the second example, where the major term "vertebrates," as the predicate of a negative proposition, is distributed in the conclusion, but in the premise, as predicate of an affirmative proposition, is undistributed.

Rule 5 warns against the fallacy of negative premises; there can be no inference from two statements of disagreement. Thus, from the premises "No Frenchmen are negroes," "No Englishmen are negroes," we cannot conclude "No Englishmen are Frenchmen." This happens to be true, but we do not learn it by inference from the premises.

Rule 6 also relates to quality. A negative premise necessitates a negative conclusion, and *vice versâ*. For by Rule 5, if one premise is negative, the other must be affirmative; and therefore when we have a negative premise, the relation of one of the extreme terms to the mean is one of disagreement, and the relation of the other to the mean is one of agreement. It follows, then, that the relation between the extreme terms themselves must be a relation of disagreement—that is, the conclusion must be negative. Similar reasoning proves the second part of the rule.

From the rules given above two other subordinate rules are deduced, which, though not so important as the six already stated, are still of use. They are—

7. From two particular premises no conclusion can be drawn.
8. If one premise be particular, the conclusion must be particular.

The deduction of these additional rules is an interesting exercise. The student can deduce them from Rules 3, 5, and 6.

OUR CERTIFICATE COURSE FOR 1903.

BY GEORGE COLLAR, B.A., B.SC.,
Head-Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON LAST MONTH'S WORK.

THEORY OF TEACHING.

1. What are the objections to the use of the term "borrowing" in teaching subtraction? What is the true explanation of the process so called? What are the advantages of teaching subtraction as "complementary addition"?
2. Describe the correct posture of a child in an ordinary writing lesson. Name one or two bad positions often adopted, and say what evils follow from them.
3. What purpose or purposes has a teacher in view in teaching arithmetic? Show what special mental faculties are called into exercise in the study and practice of arithmetic, and give examples.

ENGLISH LITERATURE.

1. Describe the references in Boswell to "the poems of Ossian."
2. Discuss Johnson's remark that "languages are the pedigree of nations."
3. Explain the words *quit, caitiff, attorneys, intestate, reverend, white-livered, demise, tetchy,* as used in *Richard the Third.*

ENGLISH HISTORY.

1. Give an account of the chief legislative enactments of the reign of Edward the Third.
2. Describe the downfall of English power in France after the treaty of Bretigny.
3. Compare Edward the Second and Richard the Second.

GEOGRAPHY.

1. Write a full account of the monsoons, and say how they affect the geography of India.
2. Give an account of the commerce of India.
3. Say how the different parts of India are governed. How is the government of India as a whole carried on?

ARITHMETIC.

What are the advantages of the "method of unity" in teaching proportion? Describe a more direct way of teaching this part of arithmetic.

ALGEBRA.

1. Prove that the sum of the roots of the equation $x^2 + px + q = 0$ is equal to $-p$, and the product $= q$. Form the equation of which the roots are $mu + nv$ and $mv + nu$, where u and v are the roots of the equation $x^2 + x + 1 = 0$.
2. Solve the equations:—

$$(1)\quad \sqrt[3]{x} + \sqrt[3]{x+1} = 1.$$

$$(2)\quad \begin{cases} x - y = m. \\ nx + my + y^2 = 0. \end{cases}$$

EUCLID.

1. Show that if a parallelogram be inscribed in a circle it must be a rectangle.
2. The sides AB, CD of a quadrilateral ABCD, about which a circle is described, are produced, and meet in P; show that AP is equal to DP, and AD is parallel to BC.
3. Show that the point of intersection of the diagonals of a quadrilateral inscribed in a circle is the vertex of two pairs of triangles which are respectively equiangular.

ELEMENTARY SCIENCE.

1. What is meant by "motion"? Why do we say that the earth turns round on its axis, and not that the heavenly bodies travel round it once a day?
2. Discuss the question of the rotation of the moon.

NOTES AND SYLLABUS FOR JANUARY.

ENGLISH COMPOSITION.

Read carefully Nichol, Part IV., chap. i. (first part), on *Plain Words*, and *Figures Founded on Resemblance.* The student should notice that two people may each say what they mean with equal correctness, but yet the account given by the one may be much more definite than that given by the other. We will consider one of the ways in which this may be brought about.

In logic we speak of the *extension* and the *intension* of terms, by which we mean respectively the number of individuals included by the term and the number of qualities implied by it. Thus, if we compare the two terms "metal" and "gold," we see that a great many substances can be described as metal which cannot be called gold. Therefore we say that the term "metal" has a greater "extension" than the term "gold." But, on the other hand, the term "gold" implies certain properties, such as colour and value, which are not implied by the more general term "metal." Therefore we say that the word "gold" has a greater *intension* than the term "metal." We might notice that if we arrange a number of similar terms in ascending order of their intension, they will be in descending order of their extension. The student will now see that the image conveyed to the mind by terms of wide extension are necessarily indefinite and lacking in detail; so, in order to make our meaning clear and definite, we must select terms having as much intension as we can find.

Bearing the above points in mind, write essays on—

1. A Winter's Day.
2. Foreign Commerce.
3. "Sweet are the uses of adversity."

THEORY OF TEACHING.

1. Finish the chapter on the methods of teaching arithmetic. Pay special attention to the illustrations to be used in the teaching of vulgar fractions. It must be a source of gratification to all true teachers to find that examiners are attaching much less importance to mere trials of long arithmetical working, and are insisting on an intelligent knowledge of the principles involved, and of short practical methods. Hence the importance of studying proofs of rules, and of contracted methods of work. The old way of working with long decimals, and of giving the answer correct to about a dozen places, might show accuracy of working, but it certainly indicated ignorance of the relative value of the various digits. The first thing in dealing with approximate calculations is to convince the pupils that all measurements are really only approximately correct. Children should be allowed to see that six quarter-pound packets of tea purchased at the same shop would all be found to differ in weight if placed in a delicate chemical balance. It must be pointed out that, in giving the distance between two towns, we consider the answer correct enough if we give the number of miles and neglect the yards; and in giving the distance between the earth and the sun, we are satisfied with the nearest million miles, and neglect the thousands. The pupils will then be brought to see that any error in stating a quantity must be considered in its relation to the whole quantity.

There are two methods by which we may obtain approximate results in our work: first, by operating with approximate values of the numbers; and secondly, by omitting unimportant parts of the working. The first method is the one to employ in addition and subtraction of decimals. Thus, to find the sum or the difference of 4·7163958 and 7·3228694 correct to two decimal places, we may find the sum or difference of 4·716 and 7·323 (why 3 and not 2 in the last place?). We operate with three places because there may be a carrying figure which will influence the second place. In multiplication and division we might also get an approximation by contracting the multiplier and multiplicand, or the dividend and divisor, as the case may be. There is, however, a difference between these two operations and the two former: for in the former each step in the working is concerned only with digits of the same order (for example, we add tenths to tenths, or subtract hundredths from hundredths), but in the case of multiplication or division this is not so; and in the full working, operations take place between each digit of one number and the digits of every order in the other. Hence it is not advisable to contract the given numbers before multiplying or dividing. For if we had to give the value of 276·4825 × 142·37618 correct to two places of decimals, and we were to take 276·48 × 142·37, although we could obtain *four* decimal places with these numbers, yet, since we omit such parts of the working as 200 × ·002 and 70 × ·002, we omit parts that affect the first and second decimal places, both of which we require to be correct. Hence, in multiplication and division, the omissions should not be made in the numbers themselves, but in their products. For examples, see the text-book of arithmetic.

2. *Cleanliness and Appearance.*—It should be taken for granted that the duty of training children in habits of cleanliness, and

the responsibility for the appearance of the children, should rest with the parents; but unfortunately most teachers find it necessary to take the matter in hand in the case of some pupils, and in poor districts the parents are often so neglectful of these duties that the teachers have to regard it as a very important part of their duty to train their children in habits of cleanliness and set before them an ideal of tidy appearance. Summarise the reasons for cleanliness, and the points that boys and girls should strive after in the matter of personal appearance.

English Literature.

Finish the *Tour to the Hebrides*.

Prepare in detail the fifth act of *Richard III.*

Scene i., line 7. *Moody*. Although the word literally denotes "in a mood," yet it has acquired the connotation "in a bad or sullen mood;" just as the phrase "in a temper" means "in a bad temper."

10. *All-Souls' Day*. November 2, the day after All Saints' Day. On this day special thoughts are directed to departed friends.

19. *The determined respite*, the appointed day to which the punishment was postponed.

Scene ii., lines 7–13. The metaphors are drawn from the pig rather than the wild boar. *Swills* = drinks; *wash* = liquid food given to pigs.

13. *Tamworth* is a town which gives its name to a well-known breed of pigs; but I cannot find that there were Tamworth pigs in Shakespeare's day, so perhaps the mention of Tamworth is only a coincidence.

Scene iii., line 50. *Beaver*, properly the part of a mediæval helmet that could be lowered to protect the face; but Richard probably refers to his whole helmet.

61. *His son George*, who had been taken by Richard as hostage for Stanley's behaviour.

81. *Father-in-law*. It should be "stepfather." Lord Stanley was the third husband of Margaret, Countess of Richmond, the mother of Henry the Seventh.

95. *Thy brother*. George was Stanley's son by his first wife, Eleanor Neville, and therefore was not Henry's brother, nor even his half-brother, as he had neither the same father nor the same mother.

105. *Peise*, weigh. (French, *peser*, to weigh.)

151. *Cousins*, another term loosely applied; it should be nephews.

221. *Play the eavesdropper*, listen to private conversation.

289. *Caparison*, saddle or dress. In those days horses wore not only leather harness, but iron or steel armour and showy horse-cloths.

341. Astonish the sky with the splinters of your lance-staves, which you will break on the enemy.

English History.

Study the period from 1399 to 1485. Most of this deals with matter of fact which is generally very well known. We shall, therefore, confine our notes to one or two important points.

(*a*) *The Claim of Henry Bolingbroke to the Throne.*—After the sentence of deposition on Richard the Second had been read in Parliament, Henry rose, crossed himself solemnly, and said: "In the name of the Father, Son, and Holy Ghost, I, Henry of Lancaster, claim this realm of England and the crown, with all the members and appurtenances thereof, inasmuch as I am descended by right line of blood from the good lord King Henry the Third, and through that right which God of His grace has sent me with help of my kin and of my friends to recover it; the which realm was in point to be ruined through default of governance, and through the overthrowing of good laws." It will be seen that this was purposely vague. 1. The claim of conquest was hinted at, but Henry was too shrewd to offend his supporters by claiming as a conqueror. 2. The popular legend that Edmund of Lancaster, from whom he was descended on his mother's side, was really the eldest son of Henry the Third, but had been set aside on account of his deformity, would not have stood close investigation, but it was referred to in order to gain a certain measure of support. 3. The claim that the change of king was for the public good would have been sufficient in itself, but Henry was astute enough to see that if he had no other claim, a similar argument might have been used against himself later on. Rightly or wrongly, the claims were admitted by Parliament as the representatives of the nation, and this parliamentary recognition effectively constituted him king. We must, however, come to the conclusion that if Henry had been content to act as regent for young Edmund Mortimer, who in 1399 was only nine years of age, the Wars of the Roses would have been avoided.

(*b*) *Relations with Scotland.*—The Scots refused to acknowledge Henry, and in 1401 he invaded Scotland and burned Edinburgh. In 1402, Earl Douglas, in attempting to retaliate, was sorely defeated by Percy (Hotspur) at Homildon Hill. Peace was further secured by the capture of young Prince James and his detention in England. The Duke of Albany, who became regent of Scotland on the death of King Robert, found that he could exercise sovereign power provided he gave no trouble to the English king, who could have restored James and ended Albany's regency.

(*c*) *Religious Persecutions.*—Instituted by Henry the Fourth in return for the support he received from the bishops and clergy, and it did not abate until the Wars of the Roses attracted people's attention.

(*d*) *The Declaration of War against France.*—The claims of Henry the Fifth were preposterous, and this war was a national crime. Henry was anxious for military glory, and his episcopal advisers hoped to increase their power.

Geography.

The rest of the geography of Asia must be studied in outline, and the great difficulty is to put the facts in their proper proportion. If the physical geography of the continent as a whole has been properly prepared, very little extra attention need be given to the physical geography of the different countries. It is important to trace the connection between causes and effect, and thus learn the geography in a scientific manner; the physical conditions, especially climate, determine the productions. These, in their turn, determine the industries; and the raw productions and industries jointly determine the commerce. In learning the chief towns of a country, not only note their position, but endeavour to ascertain what other causes account for their greatness.

The connection of the countries of Asia with the various European nations is a matter for careful consideration. India may be regarded as almost entirely under British influence, Siberia under Russian, and Tonquin under French. Note, however, the conflicting interests of Russia and Great Britain in Afghanistan and Persia; the influence of Germany in the Euphrates valley and Asia Minor, owing to railway concessions; and the influence of France in Siam. The present position of China with respect to European powers must be carefully studied. Note—(*a*) the permanent settlements of European powers in China; (*b*) the settlements leased, but more or less regarded as permanent; and (*c*) the "spheres of influence," or regions which the respective powers do not profess to own, but which they are determined shall belong to no one else.

Arithmetic.

Master the chapters on percentages. If it is clearly understood that a "percentage" is merely a fraction, no great difficulty will arise. Nearly all mistakes arise from forgetting that a percentage is an *abstract number*. Custom sanctions two forms of expression which seem to ignore this fact. Thus we say that a man carries out a certain transaction and "gains 5 per cent." This expression in itself is meaningless: it is no use saying that a man gains 5 per cent., or gains one-twentieth, unless we know *the quantity of which he gains 5 per cent.* Custom allows us to talk of a gain of "5 per cent.," when we really mean "5 per cent. of the cost price." The other incorrect form is generally used in insurance, and people then talk of insuring a house against fire at a rate of 2s. 3d. per cent. What is meant is 2s. 3d. per £100, but the meaning of the term "per cent." is not restricted in this way. If the student will accustom himself to name the quantity of which he takes the percentage, he will avoid all the common errors, such as saying that 4 per cent. of A's cost price and 5 per cent. of B's = 9 per cent.

We shall now work out one or two examples that were set in 1901:—

1. What is the lowest number which, when divided separately by 15, 20, 48, and 36, will in each case leave 9 as a remainder?

Since the lowest number which will divide exactly by 15, 20, 48, and 36 (that is, will leave 0 as a remainder) is the L.C.M. of 15, 20, 48, and 36 (see definition of L.C.M.), it follows that the lowest number which, when divided by 15, 20, 48, and 36, will leave in each case 9 as a remainder, will be the L.C.M. of 15, 20, 48, and 36 increased by 9.

L.C.M. of 15, 20, 48, and 36 = 720. Ans. 729.

2. A litre of a mixture of alcohol and water is found to weigh 854 grammes. What percentage of water is there in the mixture? (A cubic centimetre of water weighs 1 gramme, and a cubic centimetre of alcohol weighs ·8 gramme. A litre is a cubic decimetre.)

The question was apparently set by a man who had never

mixed alcohol and water, or at least had not observed in so doing that a contraction takes place, so that the volume of the mixture is not the sum of the volumes of its constituents. If this had been taken into account, the question would have been somewhat complicated. As it stands, it is simply an application of the principle of averages; for when two things are put together so as to produce a given average (price, density, etc.), the quantity of each thing taken is in inverse ratio to the amount by which it differs from the average.

Now we have average weight of 1 c.c. = ·854 gr. 1 c.c. of water weighs 1 gr., or ·146 gr. more than the average, and 1 c.c. of alcohol = ·8 gr., or ·054 less than the average. Hence they were mixed in the proportion of ·054 of water to ·146 of alcohol —that is, 54 : 146 or 27 : 73.

There was therefore $\frac{27}{27+73}$ of water = 27 per cent.

3. A man bought a horse, and sold it at a loss of 7 per cent. If he had received 18 guineas more, he would have gained 7 per cent. What did it cost him?

He actually sold it for 93 per cent. of its cost price; he might have sold it for 107 per cent. of its cost price. ∴ the difference between the two prices = 14 per cent. of its cost price. But we are told that the difference was 18 guineas.

∴ 14 per cent. of cost price = 18 guineas,

or the whole cost price = $\frac{100}{14}$ of $\frac{21}{20}$ of £18

= £135.

Euclid.

Finish the Third Book, and work exercises. We have had one or two inquiries about the necessity of following Euclid's proofs, and we may say that it is not necessary to adopt Euclid's method of proof at all. The great object of teaching geometry is to afford a training in deductive reasoning, and the student will see that in Euclid's elements the proof of each proposition is based only upon propositions which precede it. Hence no student would be allowed to prove Prop. 16 by referring to Prop. 32. The actual method of proof used by Euclid need not be followed, and frequently the alternative proofs given in the modern text-books are superior to Euclid's. Moreover, the examiners will not even demand Euclid's sequence, if the student states at the head of his paper that he has worked from some other book of geometry which is drawn up on a strictly deductive plan, and gives references to that. In most of the text-books that profess to be editions of Euclid, advantage is taken of modern developments of geometry; thus, the definition of the projection of one straight line upon another can be used to very materially shorten the enunciations of II. 12 and 13. The student should make himself familiar with the use of such terms as *locus*, to denote the line traced out by a point which moves but always fulfils certain conditions, such as the vertex of a triangle described upon a given base and having a given vertical angle.

Algebra.

Finish quadratics, including the theory and quadratics with more than one unknown. We might add the following to the three methods of solving quadratics that we gave last month:—

Solve $7x^2 - 20x - 3 = 0$.

Here, instead of adding 3 to each side and *dividing* by 7 and making the left-hand side up to the square of a binomial of which the first term is x, we might multiply by 7 and make the left-hand side up to the square of a binomial the first term of which is $7x$, thus—

$$49x^2 - 140x - 21 = 0.$$

Now, if $-140x$ is the second term in the square of a binomial of which the first term is $7x$, the second term of the binomial must be $\frac{140x}{2 \times 7x}$, or 10, and the last term of the square is 100.

Adding 121 to each side, we obtain the equation—

$$49x^2 - 140x + 100 = 121. \quad \text{(Extract the sq. root.)}$$

$$\therefore 7x - 10 = \pm 11.$$

$$\therefore 7x = 10 \pm 11 = 21, \text{ or } -1;$$

that is, $x = 3$, or $-\frac{1}{7}$.

This method of completing the square has the advantage over the ordinary method in that it does not involve fractions.

When the equation consists of two fractions, we can often simplify the working by making use of a theorem in proportion; for a ratio is nothing but a fraction, and therefore the equality of two fractions is by definition a proportion. Now, in proportion we can prove that if $a : b :: c : d$, then $a - b : a + b :: c - d : c + d$.

For if $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{b} - 1 = \frac{c}{d} - 1$, or $\frac{a-b}{b} = \frac{c-d}{d}$ . . (1)

Similarly, $\frac{a}{b} + 1 = \frac{c}{d} + 1$, or $\frac{a+b}{b} = \frac{c+d}{d}$ . . . . (2)

Dividing (1) by (2), we obtain $\frac{a-b}{a+b} = \frac{c-d}{c+d}$.

This shows us that we may form a new equation by taking difference of numerator and denominator for the new numerator, and their sum for the new denominator, or *vice versâ*. We will apply this method to the solution of the following equation set in the Certificate Examination:—

$$\frac{x^2 + 5x + 7}{x^2 - 2x + 7} = \frac{2x - 1}{x - 1}.$$

(The sum of $x^2 + 5x + 7$ and $x^2 - 2x + 7$ is $2x^2 + 3x + 14$, their difference is $7x$. The sum of $2x - 1$ and $x - 1$ is $3x - 2$, and their difference is x.) Thus we have—

$$\frac{7x}{2x^2 + 3x + 14} = \frac{x}{3x + 2}; \text{ dividing by } x,$$

$$\frac{7}{2x^2 + 3x + 14} = \frac{1}{3x + 2}.$$

A much simpler equation to work than the original one.

Multiplying by L.C.M.,

$$2x^2 + 3x + 14 = 21x + 14.$$

$$\therefore 2x^2 - 18x = 0$$

$$x^2(x - 9) = 0.$$

∴ either $x = 0$, or $x - 9 = 0$. Ans. $x = 0$ or 9.

There are several ways of solving simultaneous equations involving quadratics, and the student's ability is shown by selecting the easiest method in each case. Very often one of the equations contains no terms of a degree higher than the first. In this case it is best to get the value of one of the unknowns in terms of the other from this equation and substitute it in the other. Thus—

$$\begin{cases} x + 2y = 13, \\ x^2 - 3xy + 2y^2 = -3. \end{cases}$$

From the first, $x = 13 - 2y$.

$$\therefore (13 - 2y)^2 - 3y(13 - 2y) + 2y^2 = -3;$$

that is, $169 - 52y + 4y^2 - 39y + 6y^2 + 2y^2 = -3$;

hence $12y^2 - 91y + 172 = 0$.

$$\therefore (y - 4)(12y - 43) = 0.$$

$$\therefore y = 4, \text{ or } 3\tfrac{7}{12}.$$

$$\therefore x = 13 - 8 = 5; \text{ or } x = 13 - 4\tfrac{11}{12} = 13 - 7\tfrac{1}{12} = 5\tfrac{11}{12}.$$

Should each of the equations be homogeneous, it is best to solve for the ratio between x and y.

Elementary Science.

We considered last month the nature of position and motion, and found that motion was change of position. But one body might move twenty feet to the east in one minute, and another might move twenty feet to the east in an hour. The *amount of motion* is the same in both cases, since the two bodies are both at the same distance from their original positions. When we consider motion in relation to time, we get our idea of *velocity*. Since it would not be convenient to compare the velocities of different bodies if we simply knew that one moved twenty-one feet in thirteen seconds, another thirty-one feet in twenty-one seconds, we adopt the uniform practice of saying how many feet each body travelled in one second: thus the first body moves $1\frac{8}{13}$ feet in one second, and the other $1\frac{10}{21}$ feet in one second; and we adopt a definition of velocity which enables us to measure the velocity of any moving body. The number of units of velocity a body has is the number of units of length travelled over in one unit of time. It will be seen, then, that the unit of velocity depends upon the units adopted in measuring length and the units adopted in measuring time: thus we might express our velocity in feet per second or in miles per hour, etc. If the motion of a body is such that at any part of the time we are considering the velocity is the same, we describe the velocity as uniform. This is the same as saying that when a body moves with a uniform velocity the distance travelled is directly proportional to the time. When this is not the case the velocity is variable.

When the velocity of a body increases, it is said to be accelerated; and when it is diminished, we say that it is retarded. But the student who has gained a knowledge of negative quantities from algebra, will see that it is not necessary to regard acceleration and retardation as two separate things, for a retardation is merely a negative acceleration.

OUR SCIENCE SECTION

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PHYSIOGRAPHY.

(ADVANCED AND HONOURS.)

Foucault's Pendulum at the Panthéon.—The following particulars of the apparatus now in use at the Panthéon experiment are worth taking note of. The apparatus consists of a copper globe, weighing 66 lbs., suspended by a fine steel wire, 224 feet long, from the interior of the dome of the Panthéon. A pendulum of this length takes 16 seconds in its oscillation. From the lower end of the ball a needle projects, which, towards the end of each oscillation, marks a track in two small mounds of fine sand which are placed at the opposite extremities. In this way the exact bearing of the plane of oscillation can be seen, and the change in direction of each swing observed. In the centre of the ball a graduated circle is placed so that the angle of the swing can also be seen. In order to start the pendulum fairly and without twist, it is drawn to one side, and retained there by a thread; and to further ensure that it is not jerked in releasing, the thread is burnt through, and the great pendulum starts off on its journey across the hall. On its return, after the 16 seconds, the needle will be seen to make a fresh mark in the sand to the westward of that which it made on starting; and so it will continue, the deviation being at the rate of 11° per hour.

Kite Meteorology.—During the months of June, July, and August of this year experiments with kites were made by a committee of the Royal Meteorological Society at Crinan, on the west coast of Scotland, about thirty miles south of Oban. The apparatus, says *The Illustrated Scientific News*, consisted of:—

1. *Winding-in apparatus*, carrying two reels of 16 inches diameter and 4 inches broad to hold the wire, and two strain-pulleys to reduce the tension of the wire before it is wound. By suitable arrangements an adjustment of tension is obtained, and the risk of the reel being crushed by the tension of the many turns of the wire is avoided.

2. *The steam-engine* for turning the winches, a necessity when several miles of wire have to be wound in. This has four cylinders, each of 2½ inches diameter and 4-inch stroke, and is nominally of 6-horse power. The advantage of a steam over a petrol motor lies in the ability of the former to vary its speed according to the wind force, and thus the strain on the wire is better adjusted.

3. *The kites* are mostly of a modified Hargrave pattern. Of these there are five, and two others of the Cody type have been procured.

4. *The wire* is steel piano wire of 1-32nd-inch diameter; a length of 8 miles in one piece has been supplied. Altogether 12 miles of wire are available.

5. *The instruments* are of the well-known Richard type, but a simpler type of instrument is being experimented with.

This complete apparatus has been in use every day when the wind is suitable; but there are many days when a sufficiently strong wind does not occur—a velocity of about 15 miles an hour is considered necessary; but it may be stated that experience in kite-flying with other forms of kites than those used certainly tends to show that a wind of much less force is required, and further trials will, perhaps, result in a lighter form of kite being used in light weather.

During June, July, and August, seventy-two flights were made to heights varying from 1,500 feet up to 12,000 and 14,500 feet. Great as this latter height is, which was attained on August 25th, it does not come up to the record of either France or the United States, both of which are about 1,400 feet higher.

The temperature gradient varied from 1.50 to 4.50 per 1,000 feet. The length of wire used was usually about double that of the height attained. One or two kites were most often employed, though occasionally three, and in the highest flight four were attached to the line.

In order to facilitate the raising of the kites in light winds, a steam tug was brought into requisition, and an ascent exceeding 1,000 feet was made every day that the tug was used. The regular speed of the steamer was seven knots, though she could increase this to eight for a short time. No difficulty was experienced in flying a single kite from the vessel in any weather that occurred, but with calms and light airs no great height could be obtained.

As regards the angle at which the kites flew, that depended, of course, upon the amount of wire out, since a long line acted on by the wind has a depressing effect. The following were the best results of angular elevation of the kite:—

36°	with	9,400 ft.	of wire.
37°	,,	8,400	,,
38°	,,	7,500	,,
41°	,,	6,000	,,
51°	,,	5,500	,,
62°	,,	1,300	,,
62° 30′	,,	300	,,

Volcanic Emissions.—The following hypothesis, suggested by Professor A. E. Versill, as to the cause of the death of the 35,000 ill-fated inhabitants of St. Pierre, throws new light upon the subject of volcanic emissions; and although Professor Versill's views should not be accepted without further proof, they certainly merit more than passing consideration. According to the professor, "the heat was sufficient to cause the dissociation of hydrogen and oxygen from the water on coming suddenly into contact with highly-heated lava, and in case of sea-water the chlorine would also be dissociated from the sodium. These gases suddenly ejected with great violence, and exploding in the air above the crater, would produce precisely the effects witnessed on an unusually large scale at Martinique. The people were mostly killed by the sudden explosion of a vast volume of hydrogen and oxygen, which will account for the sudden burning of flesh and clothes, as well as of the buildings and vessels. The chlorine at the same time combining with some of the hydrogen would produce hydrochloric acid, a poisonous gas, which would quickly kill most of those not instantly destroyed by the explosion."

Distance of Nova Persei.—Mr. W. E. Wilson lately read a paper in which he explained how the distance from the earth to the Nova Persei nebula could be ascertained if the variations in the surrounding nebulosity are due to the successive lighting up of the outer extensions of a previously existent nebula. Taking the velocity of light and the angular displacement of the nebulosity in a given time, the distance of the new star may be computed to be about 15,780,000 times the distance of the sun from the earth.

The Disintegration of Coral.—In a paper published in *The Bulletin* of the American Museum (vol. xvi., art. 23), Dr. J. E. Duerden emphasises the importance of boring algæ in the disintegration of corals. "Nearly every fragment of dead coral in the West Indies is marked by a number of green specks, indicating the tunnels of an alga, and these in time lead to the breaking up of the whole mass." The author is inclined to believe that boring algæ have more to do with the formation of lagoons in coral islands than has the solution of the coral substance by the carbonic acid contained in the water. "It is just in such quiet spots as lagoons that the various boring algæ would be expected to grow most favourably, and by their incessant ramifications lead to the ultimate disintegration of any block of coral, following it even when reduced to fragments." Nevertheless, it is not to be assumed that this is by any means the sole agency in lagoon formation.

A Deep-Sea Sounder.—Herr Bamberg has invented a new deep-sea sounder which may eventually rival that of Lord Kelvin in utility. To the ordinary sounding-line is attached a weight, with a receptacle which is closed save only for a fine capillary tube which enters it. After the apparatus has been sunk to a certain depth, the pressure becomes great enough to force the water through the small tube into the vessel, and the amount of water found therein will be a reliable measure of the depth to which the sounder has sunk.

The Earth as a Conductor of Sound.—A curious instance of the transmission of sound through the earth was noticed by two French engineers at Kef. On July 22nd they happened to be in an excavation in a volcano in the Dyr Mountains, which has been extinct from time immemorial. The altitude of the excavation was about 3,400 feet above the sea-level. Suddenly they heard the sounds of heavy cannonading, the reports following at regular intervals. Returning to Kef a day or two later, they read in the papers that in the course of some naval manœuvres, the French fleet, on the day and at the hour at which they had heard the reports, had been engaged in bombarding Bizerta. The sound, therefore, must have been transmitted through the earth from Bizerta to Dyr, a distance of somewhat over 100 miles.

Apparent Deviations from Newton's Law of Gravitation.—In a paper read at the Göttingen meeting of the Astronomische Gesellschaft on August 4th, Herr Peter Lebedew reviewed the various theories which have ever been proposed to account for the apparent contradiction to the law of gravitation as observed in the repulsion of comets' tails from the sun, and he finally accepts the theory of Kepler, which attributes the repulsive force to solar radiation.

The author stated that he had recently confirmed the quantitative relation expressed in the formula for this repulsion, due to Maxwell and Bartoli.

For a spherical body, the diameter of which is great as compared with the wave-lengths of the solar radiation, the resulting action (F) is expressed, in gravitational units, by the formula

$$F = 1 - \frac{1}{10{,}000} \cdot \frac{1}{r\delta}$$

where r is the radius in centimetres and δ is the density of the body as compared with that of water. For dust particles, the diameters of which are comparable with the wave-lengths of the solar radiation, the above relation does not hold good.

This relation explains the varying behaviour of different parts of a comet, for it is obvious that, in a cometary nucleus made up of meteorites of various dimensions and densities, we should expect varying values of F.

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY T. CARTWRIGHT, B.A., B.SC.

Aluminium and Sulphuric Acid.—At the meeting of the Physical Society held November 14, 1902, a paper on "The Theory of the Aluminium Anode," by W. W. Taylor and J. K. H. Inglis, was read by Mr. Inglis. Aluminium is very slowly acted upon by dilute sulphuric acid, even at moderately high temperatures. With dilute hydrochloric acid the action is violent, and it is found that if a little hydrochloric acid or soluble chloride be added to dilute sulphuric acid, the action is as violent as with hydrochloric acid of the same concentration. The object of the present paper is to find an explanation of this anomalous behaviour of sulphuric acid, and of the effect produced by the addition of chloride. It has long been known that, when an aluminium electrode is employed as anode in a solution of a sulphate or sulphuric acid, there is a very great resistance offered to the current, and that this resistance is due to a film which separates the electrode from the solution. If the aluminium is the cathode, or if other acids are substituted for sulphuric acid, this great resistance does not exist. It seems probable that the two phenomena are related, and that the film is also the cause of the slow action of sulphuric action on aluminium. The authors have attempted to establish a theory which will explain these phenomena. The paper opens with a historical account of the subject; and it is pointed out that the question is now of practical importance in connection with the use of aluminium electrodes for the conversion of alternating currents into direct currents. The first experiments were made with a cell consisting of aluminium and platinum electrodes in dilute sulphuric acid, and were carried out to ascertain in what way the addition of certain salts affected the aluminium anode. The influence of potassium chloride, bromide, nitrate, acetate, chlorate, and thiocyanate in various concentrations was investigated, and the authors conclude that the presence of certain ions enables a large current to pass through the cell. The reason seems to be that the film of aluminium hydroxide with which the anode is covered is permeable to certain ions, but impermeable to others. The anomalous behaviour in sulphuric acid would then be due to the impermeability of the film to the $SO_4^{\cdot\cdot}$ ions, and also to the $Al^{\cdot\cdot\cdot}$ ions. This explanation is in accord with the fact that reversal of the potential difference acting upon the cell immediately causes a current to pass, the film being permeable to $H^{\cdot}$ ions. Experiments were next made upon the rates of diffusion of various ions through a film of aluminium hydroxide. It was found that several salts of potassium diffused rapidly through such a film, but that the sulphate passed through very slowly. This strengthens the argument that the abnormal behaviour of aluminium anodes in sulphuric acid is due to impermeability. It is suggested that the very small current which does pass may be due to a secondary action at the anode, in which the ions of water take part. The theory is confirmed by a series of experiments in which the peculiarities of the aluminium anode are reproduced by means of a platinum anode coated with a film of aluminium hydroxide. A further test was applied in the direct measurement of the resistance of a film of aluminium hydroxide to the passage of different ions. Quantitative experiments which the authors have performed on the effect of the presence of different ions on the reaction between aluminium and sulphuric acid show that this reaction is considerably accelerated by the addition of potassium chloride.

Conductivity of Salts in Solution.—The examination of the electrical conductivity of a large number of substances dissolved in liquid hydrocyanic acid by Messrs. Kahlenberg and Schlundt (*Journal of Physical Chemistry*, October 1902) has shown that while some salts are not such good conductors as their corresponding aqueous solutions, others conduct much better. Solutions of acids in liquid hydrocyanic acid are generally much poorer conductors than aqueous solutions, and the authors conclude that electrolytic conducting power is essentially determined by the specific nature of the compound formed when solute and solvent act on each other to form the solution. Certain chemical changes which have been investigated in hydrocyanic acid solution present remarkable peculiarities. It is found, for instance, that whereas trichloracetic acid readily attacks metallic magnesium and sodium carbonate, it has no action on zinc or calcium carbonate.

Aluminium Chlorosulphate.—A. Recoura.—By crystallisation of a solution of aluminium sulphate in boiling hydrochloric acid the author obtains the chlorosulphate of aluminium, $AlSO_4Cl,6H_2O$. This substance is very soluble in water, and very slightly soluble in alcohol. Cryoscopic measurements show that the solution in water is, not even at first, anything more than a simple mixture of aluminium sulphate and chloride. The lowering of the freezing-point of the aqueous solution of this compound is the sum of the respective lowerings of the sulphate and the chloride. The various experiments performed on this salt lead the author to believe that it has the same constitution as chromium chlorosulphate.

A General Method of Preparing Metallic Nitrides.—M. Guntz.—The author in a previous research measured the heat of formation of lithium nitride. If this substance is allowed to react on a metallic chloride, MCl, the following reaction takes place:—

$$Li_3N + 3MCl = M_3N + 3LiCl + Q \text{ calories},$$

and the number Q is generally very considerable, because lithium chloride is one of the chlorides formed with the largest evolution of heat. Thus, in the following reaction, if x is the heat of formation of the ferrous nitride—

$$2Li_3N + 3FeCl_2 = Fe_3N_2 + 6LiCl + 241{\cdot}8 \text{ cal.} + x.$$

There is a consi lerable excess of heat in this case, allowing for the formatic n of the ferrous nitride. The author, therefore, uses such a reaction to prepare the nitrides of iron, Fe_3N_2 and FeN. Li_3N acts on $FeCl_2KCl$ in a very energetic manner. The two products should first be pulverised, and then gently mixed in a crucible. This is heated, and after cooling the contents are washed with boiling water, and then dried at 100°. The nitride thus obtained, FeN, is a black compound which, when heated on platinum foil, becomes incandescent, and is transformed into iron oxide.

Barium-ammonium and Barium-amide.—M. Mentrel.—It has already been shown that metallic barium and strontium dissolve in liquid ammonia to give definite compounds. The author now examines the conditions of formation of barium-ammonium and its properties. His method of preparation con-

sists in passing ammonia gas over barium. The metal is not attacked above + 28° C. Below this temperature a red solid product is obtained, which is transformed into a blue liquid when the temperature sinks below − 23°. Towards − 50° an oily dark blue liquid separates, slightly soluble in liquid ammonia, colouring it blue. Below − 23° these compounds are stable; at − 15° they are transformed into the amide, and this transformation takes place more rapidly as the temperature is raised. An analysis of the various products gives:—At 0°, $Ba + 6{\cdot}1NH_3$; at − 23°, $Ba + 6{\cdot}3NH_3$; and at − 50°, $Ba + 6{\cdot}97NH_3$. At low temperatures, therefore, the barium-ammonium contains ammonia in slight excess, proving the absorption of this gas in the solid compound. The formula of the latter apparently is $Ba(NH_3)6$.

Moisture and the Combination of Cl and H.—The question of the influence of moisture on the combination of hydrogen and chlorine has been advanced another stage by the recent experiments of Messrs. Mellor and Russell. Great precautions were taken to ensure the purity of the gases used in the experiments, the hydrogen being prepared by the action of steam on metallic sodium, and the product purified by absorption in palladium. Pure chlorine was obtained by the electrolysis of fused silver chloride. After the gases had been left in contact with phosphorus pentoxide for nine months in the dark, it was found that a small spark at once caused a violent explosion, and complete combination took place. The mixture of dry gases could, however, be heated to 450° C. without explosion taking place, whereas a moist mixture in a similar bulb exploded at about 260° C. With the dry mixture it was further found that in sunlight no explosion takes place, but that the combination of the gases is very slow. The experiments show clearly that the presence of moisture has very considerable influence on the union of the two gases.

Plumbago.—Artificial graphite, suitable for use in lead pencils, and for other purposes, is now being made by subjecting a coke made from petroleum and mixed with iron ore to a high heat in the electric furnace.

Hydrogen from Coal Gas.—M. Claude, a French scientist, has found a way to produce hydrogen cheaply from common illuminating gas. He simply passes the gas through a tube imbedded in liquid air, and the hydrocarbon elements in the gas are liquefied or frozen out and left behind, while the hydrogen passes off.

THEORETICAL MECHANICS.

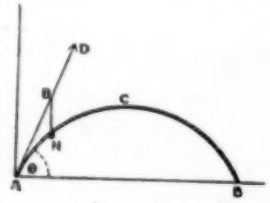
(ADVANCED AND HONOURS STAGES.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mechanics, Geometry, etc., Morley College, London; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Motion of a Projectile.—A particle projected from a point A in a direction AD, making an angle θ with the horizon, and free to move, will describe a curved path such as ACB. It is an easy matter to trace the form of the curve (when air resistance is neglected) by taking distances along a horizontal axis AB to denote time, and as ordinates the position of the particle at successive intervals of time.

Let V denote the initial velocity of projection; then the distance along AD would be Vt at the end of a time t. The acceleration due to gravity acts in a downward direction, and the vertical distance described is obtained from $\frac{1}{2}gt^2$. Thus, when t is one second, a point on the curve is obtained by setting



off to any convenient scale AB = V, and BW = $\frac{1}{2}g$. In a similar manner other points may be obtained, and the curve (a parabola) may be set out. The two rectangular components are V cos θ along the horizontal or axis of x, and V sin θ along the axis of y. The former is unaltered, but the latter is affected by gravity.

The distance AB between the point of projection and the point where the particle meets the horizontal plane through A is called the *range*.

The velocity at any instant may be obtained from

$$v = V \sin\theta - gt \quad . \quad . \quad . \quad . \quad . \quad . \quad (1).$$

If C denotes the highest point, the particle, so far as vertical motion is concerned, is at the instant at rest.

$$\therefore v = 0;$$ and we find from (1)—

$$0 = V \sin\theta - gt,$$

or,
$$t = \frac{V \sin\theta}{g} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2).$$

The time of flight, or the time taken in passing from A to B, is obviously twice that given by Eq. (2).

$$\therefore t = \frac{2V \sin\theta}{g}.$$

The height h, at any time t, may be found from the equation—

$$h = Vt \sin\theta - \tfrac{1}{2}gt^2 \quad . \quad . \quad . \quad . \quad . \quad (3).$$

To ascertain the greatest height, it is only necessary to substitute the value of t from (1) in (2).

$$\therefore h = \frac{V^2 \sin^2\theta}{g} - \frac{V^2 \sin^2\theta}{2g^2} \times g$$

$$= \frac{V^2 \sin^2\theta}{g}.$$

The range AB is obviously the product of the horizontal component and the time of flight.

$$\therefore \text{range} = V \cos\theta \times \frac{2V \sin\theta}{g}$$

$$= \frac{V^2 \sin 2\theta}{g} \quad . \quad . \quad . \quad . \quad . \quad . \quad (4).$$

From Eq. (4), as V and g are both constants, the range will be a maximum when sin 2θ is a maximum; and as the greatest value of the sine of an angle is unity, we must have sin $2\theta = 1 = 90°$.

$$\therefore \theta = 45°.$$

Hence the range is a maximum when the angle of elevation is 45°. Students familiar with simple differentiation can easily obtain the same result by the methods of the calculus.

Another important point in connection with Eq. (4) may be noticed by writing the equation in the form sin $2\theta = \frac{R \times g}{V^2}$ (where R denotes the range).

As sin $(180° - \theta)$ = sin θ, it follows that in general two values of θ satisfying the given equation can be found; in other words, for a given range two angles of projection are possible.

Ex. 1. Given the initial velocity and the range of a projectile, show that in general two angles of projection are possible.

If the initial velocity be 420 feet per second, and the range 1,800 yards, show that the angle of projection is either 39° 12′, or 50° 48′. [*N.B.*—49 sin 78° 24′ = 48.] (1902.)

From (3), range = $\frac{V^2 \sin 2\theta}{g}$.

Let R denote the range, then we have—

$$\sin 2\theta = \frac{R \times g}{V^2}$$

$$= \frac{1860 \times 3 \times 32}{420 \times 420} = \frac{48}{49}.$$

As 49 sin 78° 24′ = 48,

$$\therefore \sin 78° 24' = \frac{48}{49}.$$

$$\therefore 2\theta = 78° 24', \text{ or } 180° - 78° 24' = 101° 36'.$$

$$\therefore \theta = 39° 12', \text{ or } 50° 48'.$$

Ex. 2. If a be the angle of elevation at which a projectile strikes a given mark, θ the angle of projection, prove that tan θ + tan a = 2.

The horizontal component is given by $x = Vt \cos\theta$.

The vertical component is given by $y = Vt \sin\theta - \frac{1}{2}gt^2$.

Eliminating t, we find—

$$y = x \tan\theta - \frac{\frac{1}{2}gx^2}{V^2 \cos^2\theta} \quad . \quad . \quad . \quad . \quad . \quad (1).$$

As the angle which the given mark subtends at the point of projection is 45°, the components are equal—that is, $y = x$.

Substituting in (1), we find—

$$x(V^2 \cos^2\theta) = x(\tan\theta\, V^2 \cos^2\theta) - \tfrac{1}{2}gx^2.$$

$$\therefore x = \frac{2V^2 \cos^2\theta(\tan\theta - 1)}{g} \quad . \quad . \quad . \quad (2).$$

The tangent at any point of the curved path is given by $\frac{dy}{dx}$. Hence, differentiating (1), we get—

$$\frac{dy}{dx} = \tan\theta - \frac{gx}{V^2 \cos^2\theta} \quad . \quad . \quad . \quad . \quad . \quad (3).$$

Substitute in (3) the value of x from (2).

$$\therefore \frac{dy}{dx} = \tan\theta - 2\tan(\theta - 1).$$

Also, $\frac{dy}{dx}$ is $\tan\alpha$.

$$\therefore \tan\theta + \tan\alpha = 2.$$

ELECTRICITY AND MAGNETISM.

(ADVANCED AND HONOURS STAGES.)

BY EDWIN EDSER, A.R.C.S., F.PH.S.

Magnet Winding of Dynamos and Motors.—On the supposition that the magnets of a dynamo are of sufficient strength to produce a flux of B lines per sq. cm. in the air gap, we have seen that, when the armature is rotated at a speed of n turns per minute, the E.M.F. generated is equal to $\frac{2\pi n}{60} \cdot Nl B$ in *c.g.s.* units, where N is the number of wires cutting lines of force under a single pole, and l is the length of each of these active wires. In order to generate an E.M.F. of reasonable magnitude, it is necessary that B should be large, or that the magnets should be of considerable strength. In the earlier machines permanent magnets were sometimes used. This procedure led to unsatisfactory results, since a magnet, even when made of the hardest steel, is far from permanent in strength; and it was found that invariably, after a longer or shorter interval, the magnetisation diminished to a negligible magnitude, so that in the end the machine ceased to work. Another plan, adopted at an early date, was to use soft iron magnet cores, and to magnetise these by a current derived from batteries, after the manner generally used with respect to electro-magnets. By winding a sufficient number of turns of wire round the magnet limbs, a very small current could be used to produce a high degree of magnetisation; for the efficiency of an electric current, considered as a magnetising agent, depends on the strength of the current multiplied by the number of complete turns of wire surrounding the magnet core. Thus, in magnetising iron, the factor to be considered is the number of ampère-turns in the magnetising circuit. The use of batteries to furnish the magnetising current would doubtless have been continued if no better expedient had presented itself, although the care of batteries would have added considerably to the necessary work in a generating station. At present, however, the magnets of a dynamo are kept up to the requisite strength by means of the whole or part of the current generated by the dynamo, which is caused to circulate around the magnet limbs.

In a series-wound dynamo, the whole of the current flowing through the armature is caused to traverse a number of turns of thick wire which encircle the magnet limbs, before reaching the external circuit. In this arrangement no current can flow through the magnet windings until the external circuit is closed. Before closing the external circuit, the field magnets will possess only a small portion of their maximum strength. But this "residual magnetisation" will suffice to produce a small E.M.F. in the armature; and on closing the external circuit, this E.M.F. will generate a small current which, if it flows round the magnets in a suitable direction, will increase their strength, so that a greater E.M.F. will be produced, and this, in turn, will drive a stronger current through the field windings. In a short time the magnets will have become sufficiently magnetised for a considerable E.M.F. to be produced. If the resistance in the external circuit is diminished, the current will obviously be increased, so that the strength of the magnets will be increased, and with it the value of the E.M.F. generated. Thus a series-wound dynamo possesses the characteristic that, on open circuit, only a negligible E.M.F. will be generated; but on closing the external circuit, an E.M.F. is generated which increases in magnitude as the resistance in the external circuit is diminished, or as the current in the external circuit increases.

In a shunt-wound dynamo, the field windings consist of many turns of fine wire, connected directly across the brushes of the machine. The field windings are thus connected in parallel with the external circuit, and the field current will be nearly independent of the resistance in the external circuit. If the armature of a shunt-wound dynamo is set in rotation, the residual magnetisation of the magnets will produce a certain number of lines of force in the air gap, and since the armature conductors cut these lines of force, an E.M.F. will be generated, which drives a current through the field coils, whether the external circuit is closed or no. By this means the strength of the magnets is increased, with the result that the E.M.F. increases, and produces an increased current in the field coils, and so on, until the full E.M.F. of the machine is generated.

The current in the field coils is found by dividing the difference of potential between the brushes by the resistance of the field coils. The difference of potential between the brushes is equal to the E.M.F. generated by the armature, *minus* the drop of pressure which occurs within the armature. The drop of pressure within the armature is found by multiplying the total armature current by the armature resistance; consequently it appears that, even if an absolutely constant E.M.F. were generated by the armature, the difference of potential between the brushes would decrease as the armature current increased. In a similar manner, the difference of potential between the terminals of a battery decreases as the current increases. In a shunt-wound dynamo there is an additional effect to be taken into account. As the difference of potential between the brushes diminishes, the current in the magnetising circuit will diminish in the same proportion. As a result, the magnet strength diminishes, which, in its turn, leads to a diminished E.M.F. If the armature resistance is small, the drop of pressure within the armature will be very small, unless the armature current is very great; thus, a shunt-wound dynamo generates a constant E.M.F. so long as the current in the external circuit is not excessively great. If, on the other hand, the resistance of the external circuit is diminished beyond a certain point, the E.M.F. generated rapidly decreases, and may even fall to zero. Thus there is less liability to burn up the armature of a dynamo when the field is shunt-wound than when it is series-wound. In the latter case, since the E.M.F. generated increases with the current, the armature will inevitably be burned up if the brushes are short-circuited.

The field windings for motors are similar to those for dynamos. In either type of machine, the speed on light load is determined by the circumstance that the rotation of the armature must produce a back E.M.F. numerically equal to the direct E.M.F. of supply. This leads to certain consequences which would not at first sight be anticipated. Since the back E.M.F. is proportional to the product of n (the speed) and B (the flux in the air gap), it follows that if we increase B, then n must decrease, their product remaining constant. Thus, the greater the strength of the field magnets, the smaller will be the speed of the motor. Conversely, the weaker the field magnets, the greater will be the speed of the motor. Thus, inserting a resistance in the field circuit of a shunt-wound motor increases the speed of the motor. When the resistance in the field circuit of a shunt-wound motor remains constant, the current in the field circuit will be constant if the E.M.F. of the supply is constant; consequently, B remains constant, and the speed of the motor is only slightly affected by the load. The cause of the small diminution of speed as the load increases was explained in the problem at the end of last month's article.

In the case of a series-wound motor, since the current at any instant flowing through the armature must be just sufficient to produce a driving torque equal to the resisting torque, it follows that an increase of load must increase the current, and since this current circulates round the magnet limbs, it must increase the strength of the magnets and the value of B. But when B is increased, the speed is diminished. Thus, with a series-wound motor, the speed diminishes rapidly as the load increases.

We may now briefly summarise the conclusions arrived at:—

A series-wound machine, used as a dynamo, generates an E.M.F. which increases with the current; used as a motor, it runs at a speed which rapidly diminishes as the load increases.

A shunt-wound machine, used as a dynamo, generates an E.M.F. which is approximately constant whatever may be the current; used as a motor, it runs at a speed which is approximately constant, whatever may be the load.

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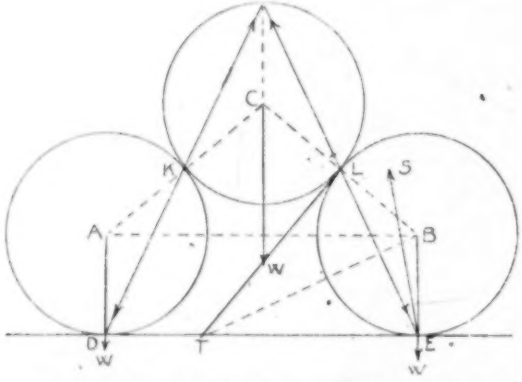
Carrett.—Two equal and similar rough cylinders whose axes are parallel, and which rest on a rough horizontal plane, support another equal cylinder (whose axis is parallel to theirs) on the top of them. Calculate the frictions at the various points of contact; and show that if the equilibrium is disturbed, it will happen through the two lower cylinders sliding along the planes. (Cambridge Senior, 1889.)



Let the figure represent the section of the cylinders made by a vertical plane passing through the centres of gravity of all three cylinders, and therefore perpendicular to their axes. Let the angle ACB, for any position of the cylinders consistent with equilibrium, be represented by 4θ.

Consider the equilibrium of the cylinder B. This is in equilibrium under the action of three forces—namely, its weight W, acting through E; the total resistance of the horizontal plane, which also acts through E; and the total resistance of the cylinder C acting through the point of contact L. Since the first two of these forces act through E, the direction of the third must also pass through E; hence the total resistance of the cylinder C on the cylinder B acts along LE. Let EL produced meet the vertical through C in the point H. Then, by parallels, the angle CHL is equal to the angle BEL. But the angle BEL = the angle BLE = the angle CLH. Hence the angle CHL = the angle CLH, and therefore H is the highest point in the circumference of the cylinder C.

Again, the cylinder C is in equilibrium under the total resistances of the cylinders A and B, acting along KH and LH respectively, and its weight W acting along the vertical HC. Also, since the angle ACB is denoted by 4θ, the angle CHL is denoted by θ. Hence, if R denote the total resistance of the cylinder B on the cylinder C, we have $R \cos\theta = \frac{W}{2}$.

Again, the normal reaction at L is equal to R cos HLC = R cos θ. Therefore the normal reaction at L is equal to $\frac{W}{2}$. Hence the friction at L is equal to $\frac{W}{2}\tan\theta$, and it is obvious that the friction at K has the same value.

Next, consider the cylinder B as at rest under the action of five forces—namely, the weight W acting along BE, the normal reaction at L acting along LB, the normal reaction of the plane acting along EB, and the frictions at L and E acting along the tangents LT and ET respectively. The resultant of the first three passes through B; and since for equilibrium the resultant of the last two must be in the same line with the resultant of the first three, the resultant of the frictions must pass through B. And this last resultant passes through T; therefore BT is the direction of the resultant of the frictions at L and E.

But BT is equally inclined to LT and ET. Hence the frictions at L and E are equal. And it is obvious that the friction at D is equal to the friction at E. Hence the friction is the same at all the points of contact—L, K, D, and E—and is in each case equal to $\frac{W}{2}\tan\theta$.

Again, consider the cylinder B as at rest under the action of three forces—namely, its weight W acting along BE, the total resistance of the cylinder C acting along LE, and the total resistance of the plane at E. The direction of the latter must obviously be along some line ES within the angle LEB. Let ϕ denote the angle BES, then ϕ is less than θ.

Now, suppose the two lower cylinders to be gradually drawn apart until the angle ACB becomes equal to four times the angle of friction. Then θ, the angle which the total resistance at L makes with the normal, will be equal to the angle of friction; whilst ϕ, the angle which the total resistance of the plane makes with the normal at E, will be less than the angle of friction. Hence the initial motion of the system will consist of slipping at L and K, and rotation at E and D. This will continue until the angle we have denoted by ϕ becomes equal to the angle of friction. The two lower cylinders will *then* slide apart along the plane.

Ethel.—A person's income is derived from the proceeds of £4550 at a certain rate per cent., and £5420 at 1 per cent. more than the former. His whole income is £453. Determine the rates. (Hamblin Smith's *Arithmetic.*)

The portion of income due to the extra 1 per cent. interest obtained from the second sum is $£\frac{5420 \times 1}{100}$, or £54·2.

Hence the income which would have been obtained from £(4550 + 5420) at the lower rate is £(453 − 54·2), or £398·8.

∴ the income from £9970 at the lower rate being £398·8,

" " £1 " " is $£\frac{398\cdot8}{9970}$,

and " £100 " " $£\frac{39880}{9970}$.

Since $£\frac{39880}{9970}$ = £4, the lower rate of interest is 4 per cent., and therefore the higher rate is 5 per cent.

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Lady Winifred.—We should advise you to read Millar's *Descriptive Geometry.*

Quis?—*Matriculation English Course*, by W. H. Low and J. Briggs (Clive and Co.), covers the requirements in that subject for London Matriculation.

Caligo.—If $x = 2\cos(\beta-\gamma) + \cos(\theta+\alpha) + \cos(\theta-\alpha)$
$= 2\cos(\gamma-\alpha) + \cos(\theta+\beta) + \cos(\theta-\beta)$
$= -2\cos(\alpha-\beta) - \cos(\theta+\gamma) - \cos(\theta-\gamma)$,
prove that $x = \sin^2\theta$, provided that the difference between any two of the angles α, β, γ neither vanishes nor equals a multiple of π. (Mathematical Tripos, 1875.)

Equating the first and third of the given values of x, we have $2\cos(\beta-\gamma) + \cos(\theta+\alpha) + \cos(\theta-\alpha) + 2\cos(\alpha-\beta) + \cos(\theta+\gamma) + \cos(\theta-\gamma) = 0$.

Hence, by expansion and reduction, we obtain—

$$\cos\theta(\cos\alpha + \cos\gamma) + \cos(\beta-\gamma) + \cos(\alpha-\beta) = 0.$$

$$\therefore \cos\theta \cdot \cos\frac{\alpha+\gamma}{2} \cdot \cos\frac{\alpha-\gamma}{2} + \cos\frac{\alpha-\gamma}{2} \cdot \cos\left(\beta - \frac{\alpha+\gamma}{2}\right) = 0.$$

$$\therefore \cos\theta\cos\frac{\alpha+\gamma}{2} + \cos\left(\beta - \frac{\alpha+\gamma}{2}\right) = 0 \quad \ldots \quad \text{(i)}.$$

Similarly, from the second and third of the given values of x, we have—

$$\cos\theta\cos\frac{\beta+\gamma}{2} + \cos\left(\alpha - \frac{\beta+\gamma}{2}\right) = 0 \quad \ldots \quad \text{(ii)}.$$

Eliminating $\cos\theta$ between (i) and (ii), we have—

$$\cos\frac{\alpha+\gamma}{2}\cos\left(\alpha - \frac{\beta+\gamma}{2}\right) = \cos\frac{\beta+\gamma}{2} \cdot \cos\left(\beta - \frac{\gamma+\alpha}{2}\right).$$

$$\text{Hence } \cos\left(\frac{\alpha-\beta}{2} - \gamma\right) + \cos\frac{3\alpha-\beta}{2}$$
$$= \cos\left(\frac{\alpha-\beta}{2} + \gamma\right) + \cos\frac{\alpha-3\beta}{2}$$
$$\therefore \cos\left(\frac{\alpha-\beta}{2} + \gamma\right) - \cos\left(\frac{\alpha-\beta}{2} - \gamma\right)$$
$$= \cos\frac{3\alpha-\beta}{2} - \cos\frac{\alpha-3\beta}{2}.$$
$$\therefore \sin\frac{\alpha-\beta}{2}\sin\gamma = \sin(\alpha-\beta)\sin\frac{\alpha+\beta}{2}$$
$$= 2\sin\frac{\alpha-\beta}{2}\cos\frac{\alpha-\beta}{2}\sin\frac{\alpha+\beta}{2}.$$

Hence, since by hypothesis $\sin\frac{\alpha-\beta}{2}$ is not zero, we have

$$\sin\gamma = 2\cos\frac{\alpha-\beta}{2} \cdot \sin\frac{\alpha+\beta}{2} = \sin\alpha + \sin\beta.$$

$$\therefore \sin\beta = \sin\gamma - \sin\alpha \quad \ldots \quad (3).$$

Again, from (i), we have—

$$\cos\theta\cos\frac{\alpha+\gamma}{2} + \cos\beta\cos\frac{\alpha+\gamma}{2} + \sin\beta\sin\frac{\alpha+\gamma}{2} = 0.$$

$$\therefore \cos\theta + \cos\beta + \sin\beta\tan\frac{\alpha+\gamma}{2} = 0.$$

Hence, and from (3), we have—

$$\cos\theta + \cos\beta + (\sin\gamma - \sin\alpha)\tan\frac{\alpha+\gamma}{2} = 0.$$

$$\therefore \cos\theta + \cos\beta + 2\cos\frac{\alpha+\gamma}{2}\sin\frac{\gamma-\alpha}{2} \cdot \tan\frac{\alpha+\gamma}{2} = 0.$$

$$\therefore \cos\theta + \cos\beta + 2\sin\frac{\gamma-\alpha}{2} \cdot \sin\frac{\alpha+\gamma}{2} = 0.$$

Hence $\cos\theta + \cos\beta - (\cos\gamma - \cos\alpha) = 0$.

$\therefore \cos\theta = -\cos\alpha - \cos\beta + \cos\gamma$.

But $x = 2\cos(\beta-\gamma) + 2\cos\theta\cos\alpha$
$= 2\cos(\beta-\gamma) + 2\cos\alpha(\cos\gamma - \cos\alpha - \cos\beta)$
$= 2\cos\beta\cos\gamma + 2\sin\beta\sin\gamma + 2\cos\gamma\cos\alpha - 2\cos^2\alpha - 2\cos\alpha\cos\beta$
$= 2\cos\beta\cos\gamma + 2\sin\beta(\sin\beta + \sin\alpha) + 2\cos\gamma\cos\alpha - 2\cos^2\alpha - 2\cos\alpha\cos\beta$
$= 2\cos\beta\cos\gamma + 2\sin^2\beta + 2\sin\alpha\sin\beta + 2\cos\gamma\cos\alpha - 2\cos^2\alpha - 2\cos\alpha\cos\beta$
$= 2\cos\beta\cos\gamma + \sin^2\beta + \sin\beta(\sin\beta + 2\sin\alpha) + 2\cos\gamma\cos\alpha - 2\cos^2\alpha - 2\cos\alpha\cos\beta.$
$= 2\cos\beta\cos\gamma + \sin^2\beta + (\sin\gamma - \sin\alpha)(\sin\gamma + \sin\alpha) + 2\cos\gamma\cos\alpha - 2\cos^2\alpha - 2\cos\alpha\cos\beta$
$= 2\cos\beta\cos\gamma + \sin^2\beta + \sin^2\gamma - \sin^2\alpha + 2\cos\gamma\cos\alpha - 2\cos^2\alpha - 2\cos\alpha\cos\beta$
$= 1 - (\cos\gamma - \cos\alpha - \cos\beta)^2$
$= 1 - \cos^2\theta = \sin^2\theta$. *Q.E.D.*

J.B.H.—Prove *geometrically*, taking A + B to be an acute angle, that $\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$; and find the least positive value of A which satisfies the equation

$$\cos(270^\circ + A) + \cos(90^\circ - 3A) = \cos A.$$

(College of Preceptors, 1901.)

The first part is given in nearly all modern treatises on trigonometry. (See Lock's *Elementary Trigonometry*, Art. 160.)

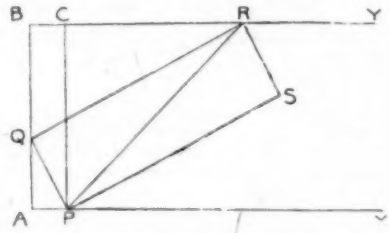
Expressing the left-hand side of the given equation in the form of a product, we have

$$2\cos\left\{\frac{(270^\circ + A) + (90^\circ - 3A)}{2}\right\}$$
$$\cos\left\{\frac{(270^\circ + A) - (90^\circ - 3A)}{2}\right\} = \cos A.$$

$\therefore 2\cos(180^\circ - A) \cdot \cos(90^\circ + 2A) = \cos A.$
$\therefore 2(-\cos A) \cdot (-\sin 2A) = \cos A.$
$\therefore 2\cos A \cdot \sin 2A = \cos A.$
Hence either (i) $\cos A = 0$, or (ii) $\sin 2A = \frac{1}{2}$.
The least positive value of A which satisfies (i) is $A = 90^\circ$; and the least positive value of A which satisfies (ii) is $A = 15^\circ$. Hence the least positive value of A which satisfies the given equation is $A = 15^\circ$.

Ralpho.—AX and BY are two parallel straight lines, like directed, AB being a common perpendicular whose length is 5 feet. PQRS is a rectangle whose sides PQ and QR are 2 feet and 7 feet respectively. If P lies on AX, Q on AB, and R on BY, find a quadratic equation for AQ; solve it, and point out which of the solutions fits the problem.

(University Prelim., Sept. 1902.)



Join PR. Let PC, drawn parallel to AB, meet BY in C. Let x denote the length of AQ in feet. Then $(5-x)$ feet is the length of QB. $AP^2 = PQ^2 - AQ^2 = 4 - x^2$.

$\therefore AP = \sqrt{4-x^2}$. $\therefore BC = \sqrt{4-x^2}$.
Again $BR^2 = QR^2 - QB^2 = 7^2 - (5-x)^2 = 24 + 10x - x^2$.
$\therefore CR = \sqrt{24+10x-x^2} - \sqrt{4-x^2}$.
Now $PR^2 = PC^2 + CR^2 = PQ^2 + QR^2$.
$\therefore 5^2 + \{\sqrt{24+10x-x^2} - \sqrt{4-x^2}\}^2 = 2^2 + 7^2$.
$\therefore 24 + 10x - x^2 + 4 - x^2 - 2\sqrt{(4-x^2)(24+10x-x^2)} = 2^2 + 7^2 - 5^2$.
$\therefore \sqrt{(4-x^2)(24+10x-x^2)} = 5x - x^2$.
$\therefore (4-x^2)(24+10x-x^2) = 25x^2 - 10^3 + x^4$.
$\therefore 96 + 40x - 28x^2 - 10x^3 + x^4 = 25x^2 - 10x^3 + x^4$.
$\therefore 53x^2 - 40x - 96 = 0$.

$$\text{Hence } x = \frac{20 \pm \sqrt{400 + 53 \times 96}}{53} = \frac{20 \pm 74{\cdot}08\ldots}{53}.$$

The positive value of x fits the problem.
$\therefore AQ = 1{\cdot}77\ldots$ feet.

Vaterland.—A weight of 12 oz. is moved from rest on a smooth horizontal table by a weight of 4 oz., which hangs over the edge of the table, and is connected with the weight on the table by means of a fine string passing over a smooth pulley at the edge of the table. Find the tension of the string, the velocity acquired in 4 secs., and the distance traversed in that time.

You evidently have failed to make out the applications of "Newton's Third Law," and it is difficult from your query to see where your difficulty is. It is only possible to give a few general notions which may tend to make the matter clearer. Thus, if a body rests on a table or other support, the reaction of the table is exactly equal in magnitude to the weight of the body. If a force be applied in a horizontal direction by means of a string or in any other convenient way, the magnitude of the force necessary to cause motion

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will depend upon the state of the surfaces in contact. If these are rough, the coefficient of friction μ, and W the weight of the body, then motion will occur when the force is greater than μW, and the body is just on the point of moving when $F = \mu W$.

Now let the surfaces be smooth. Then $\mu = 0$; that is, $F = 0$. In other words, the slightest force will produce motion, and the resistance of the body is not (as you suggest) due to the reaction of the table, but is simply and entirely due to the mass of the body and the acceleration produced. If F denotes the force, a the acceleration, and M the mass of the body, then we have the relation $F = Ma$, or the force is measured by the acceleration produced, and the reaction of the table, always at right angles to the direction of motion, has no component in that direction, and therefore does no work either to retard or to accelerate the motion. If you carefully read over and try to make out the full meaning of "Newton's Second Law" given above, you will probably see that the only means of resistance is in the motion produced.

Referring to the question, if P denotes the mass descending vertically, T the tension of the string, and Q the mass moved, then on the vertical side the force causing motion is

$$Pg - T. \quad \therefore a = \frac{Pg - T}{P}. \quad . \quad . \quad . \quad . \quad . \quad (ii)$$

The acceleration of the mass on the table is given by

$$a = \frac{T}{Q \div g}.$$

And assuming the acceleration of each to be the same, we have

$$T = \frac{PQ}{P + Q}.$$

Hence, substituting the given values,

$$T = \frac{4 \times 12}{4 + 12} = 3 \text{ oz.}$$

From (ii), $a = \frac{4g - 3g}{4} = \frac{1}{4}g$.

If v denotes the velocity acquired in a time t, then $v = at = g = 32{\cdot}2$ feet per sec. per sec. The space s described in 4 seconds is given by

$$s = \tfrac{1}{2}at^2 = \frac{g}{8} \times 16 = 2g = 64{\cdot}4 \text{ feet, if } g = 32{\cdot}2.$$

A. W. B.—If θ be the angle of elevation at which a projectile strikes a given mark, a the angle of projection, and 45° the angle which the given mark subtends at the point of projection, prove that $\tan a + \tan \theta = 2$, and determine the time to reach the wall.

Probably the most convenient method of dealing with questions of this kind is by considering separately the horizontal and vertical motions of the projectile. Thus let V denote the initial velocity of projection and a the angle of projection. Then the horizontal component of the motion is given by $x = V \cos a \times t, \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$ and the vertical component by

$$y = V \sin a \times t - \tfrac{1}{2}gt^2, \quad . \quad . \quad . \quad (2)$$

Eliminating t from (1) and (2), we find

$$y = \tan a - \frac{\frac{1}{2}gx^2}{V^2 \cos^2 a}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

As the angle which the given mark subtends at the point of projection is 45°, the components are equal—that is, $y = x$. Substituting in (3), we find

$$x(V^2 \cos^2 a) = x(\tan a\ V^2 \cos^2 a) - \tfrac{1}{2}gx^2,$$

$$\text{or } \tfrac{1}{2}gx^2 = xV^2 \cos^2 a\ (\tan a - 1).$$

$$\therefore x = \frac{2V^2 \cos^2 a\ (\tan a - 1)}{g}. \quad . \quad . \quad (4)$$

The tangent at any point of the curved path of the projectile is given by $\frac{dy}{dx}$.

Thus differentiating (3), we have

$$\frac{dy}{dx} = \tan a - \frac{gx}{V^2 \cos^2 a}. \quad . \quad . \quad . \quad . \quad . \quad (5)$$

Substitute in (5) the value of x from (4),

$$\therefore \frac{dy}{dx} = \tan a - 2(\tan a - 1).$$

$$\text{Also } \frac{dy}{dx} \text{ is } \tan \theta.$$

$$\therefore \tan \theta + \tan a = 2.$$

To find the time to reach the wall, we may assume the distance from the point of projection to the wall to be denoted by a.

Then from (1), $t = \frac{x}{V \cos a}$.

And time to reach the wall is $\frac{2V \cos a\ (\tan a - 1)}{g}$.

Also $a = \frac{2V^2 \cos^2 a\ (\tan a - 1)}{g}$.

From which, substituting for V, we have time required

$$= \frac{2 \cos a\ (\tan a - 1)}{g} \times \sqrt{\frac{ag}{2 \cos^2 a\ (\tan a - 1)}}$$

$$= \sqrt{\frac{2a\ (\tan a - 1)}{g}}.$$

Bike.—Prove that

$$\log\left\{\frac{1}{x}e^{\frac{x}{2}} \log(1 + x)\right\} = \frac{5x^2}{24} - \frac{x^3}{8} + \frac{251}{2880}x^4 \quad . \quad . \quad .$$

(Edwards's *Differential Calculus.*)

Let $f(x)$ be the function to be expanded; then

$$f(x) = \log\left\{\frac{1}{x}e^{\frac{x}{2}} \log(1 + x)\right\} = \frac{x}{2} + \log\left\{\frac{\log(1 + x)}{x}\right\}.$$

Further, by a well-known expansion,

$$\log(1 + x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - \quad . \quad . \quad .$$

$$\therefore \frac{\log(1 + x)}{x} = 1 - \frac{x}{2} + \frac{x^2}{3} - \frac{x^3}{4} + \frac{x^4}{5} - \quad . \quad . \quad .$$

$$\therefore f(x) = \frac{x}{2} + \log\left\{1 - \frac{x}{2} + \frac{x^2}{3} - \frac{x^3}{4} + \frac{x^4}{5} - \ldots\right\} \quad . \quad . \quad . \quad (1)$$

Also, let

$$f(x) = A + Bx + Cx^2 + Dx^3 + Ex^4 + \quad . \quad . \quad . \quad (2)$$

Substituting $x = 0$ in (1) and (2), we find that $A = 0$.
Differentiating (1) and (2), and equating, we find that

$$\frac{\frac{1}{2} + \frac{-\frac{1}{2} + \frac{2x}{3} - \frac{3x^2}{4} + \frac{4x^3}{5} - \frac{5x^4}{6} + \ldots}{1 - \frac{x}{2} + \frac{x^2}{3} - \frac{x^3}{4} + \frac{x^4}{5} - \ldots}}{} = B + 2Cx + 3Dx^2 + 4Ex^3 + \ldots$$

Substituting $x = 0$, we find that $B = 0$. Discarding B, and multiplying both sides by $\left(1 - \frac{x}{2} + \frac{x^2}{3} - \frac{x^3}{4} \ldots\right)$, we obtain

$$\left(\frac{1}{2} - \frac{x}{4} + \frac{x^2}{6} - \frac{x^3}{8} + \frac{x^4}{10} - \ldots\right) + \left(-\frac{1}{2} + \frac{2}{3}x - \frac{3x^2}{4} + \frac{4x^3}{5} - \frac{5x^4}{6} + \ldots\right)$$

$$= \{2Cx + 3Dx^2 + 4Ex^3 + \ldots\}\left\{1 - \frac{x}{2} + \frac{x^2}{6} - \frac{x^3}{8} + \ldots\right\}.$$

$$\therefore \frac{5}{12}x - \frac{7}{12}x^2 + \frac{27}{40}x^3 \ldots$$

$$= 2Cx + (3D - C)x^2 + \left(4E - \frac{3}{2}D + \frac{C}{3}\right)x^3 + \ldots$$

Equating coefficients of equal powers of x, we obtain

$$2C = \frac{5}{12}. \quad \therefore C = \frac{5}{24}.$$

$$3D - C = 3D - \frac{5}{24} = -\frac{7}{12}. \quad \therefore D = -\frac{1}{8}.$$

$$4E - \frac{3}{2}D + \frac{C}{3} = 4E + \frac{3}{16} + \frac{5}{72} = \frac{27}{40}. \quad \therefore E = \frac{321}{2880}.$$

$$\therefore f(x) = \frac{5}{24}x^2 - \frac{x^3}{8} + \frac{321}{2880}x^4 \ldots$$

This result differs only in the numerator of the fractional coefficient of x^4 from that given in query.

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Magnet.—The magnet NS, of moment M, is placed "broadside on" at a distance d from the needle ns, which swings in a field of intensity H. If θ is the angular deflection of the needle, prove that $\frac{M}{H} = d^3 \tan \theta$.

Since the magnet NS is placed "broadside on" to the needle ns, the field f due to NS will be at right angles to H (Fig. 1). The resultant R of the fields f and H can be found

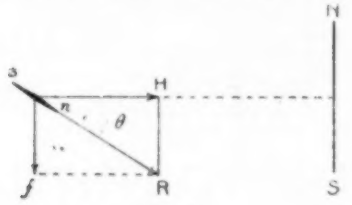

Fig. 1.

by the parallelogram of forces. The needle will point along the resultant field R, and since f, H, and R form the sides of a right-angled triangle, with angle θ, it is easily seen that

$$\frac{f}{H} = \tan \theta.$$

We must now find the value of f. Let the point A (Fig. 2)

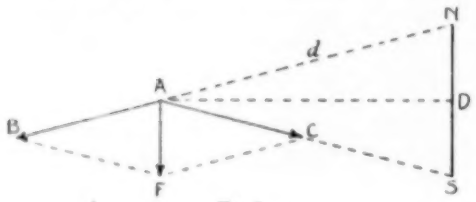

Fig. 2.

be at a distance d from either N or S. Then the field at A, due to the pole N (supposed of strength m), is equal to $\frac{m}{d^2}$. The direction of this field is away from N, in the straight line NA. Let $AB = \frac{m}{d^2}$.

The field at A, due to the pole S, is equal to $-\frac{m}{d^2}$. The direction of this field is toward S, in the straight line AS. Let $AC = \frac{m}{d^2}$.

To find the resultant of the two equal forces, AB and AC, complete the parallelogram ACFB, and draw the diagonal AF. The line AF will be equal to f, the resultant field at A due to the magnet NS. It is easily seen that AF is parallel to NS, so that the triangle ACF is similar to the triangle NAS. Thus $\frac{AF}{AC} = \frac{NS}{AN}$.

Let $NS = l$. Then, since $AC = \frac{m}{d^2}$,

$$f = AF = \frac{m}{d^2} \cdot \frac{l}{d} = \frac{M}{d^3},$$

if $ml = M$ = the moment of the magnet NS.

When the distance of the point A from the magnet is large in comparison with l, the length of NS, then the distance of the point A from D, the middle point of the magnet, will be approximately equal to d, the distance AN.

$$\therefore \frac{f}{H} = \frac{M}{d^3 H} = \tan \theta.$$

$$\frac{M}{H} = d^3 \tan \theta.$$

Cheerimug.—Obtain a solution by a series of

$$(1 - x^2)\frac{d^2y}{dx^2} + m(m-1)y = 0,$$

and give the symbolical expression of the complete solution.
(Lamb's *Calculus*, p. 565.)

Let $y = A_0 + A_1x + A_2x^2 + A_3x^3 + \ldots + A_nx^n + \ldots + A_{-1}x^{-1} + A_{-2}x^{-2} + \ldots = \Sigma A_n x^n$, where n may have any integral value, positive or negative.

On substituting in the differential equation, we obtain a series of integral powers of x, and this series must be equal to zero for all values of x. Hence the coefficient of each power of x must be equal to zero. The term involving x^n will be equal to

$$\{(n+2)(n+1)A_{(n+2)} - n(n-1)A_n + m(m-1)A_n\}x^n.$$

$$\therefore (n+2)(n+1)A_{(n+2)} - \{n(n-1) - m(m-1)\}A_n = 0.$$

$$\therefore A_n = \frac{(n+2)(n+1)}{(n-m)(n+m-1)}A_{(n+2)}. \quad \ldots\ldots\ldots \quad (1)$$

The right-hand side of this equation becomes equal to 0, when $n = -2$, or $n = -1$. Thus $A_{-1} = 0$, and $A_{-2} = 0$.

Also, if $A_{(n+2)} = 0$, $A_n = 0$, $A_{(n-2)} = 0$, . . . etc.

Hence, since $A_{-2} = 0$, we have $A_{-4} = 0$, $A_{-6} = 0$, . . . etc.

And since $A_{-1} = 0$, we have $A_{-3} = 0$, $A_{-5} = 0$, . . . etc.

Thus the series which satisfies the equation will contain no negative powers of x.

Now from (1),

$$A_2 = -\frac{m(m-1)}{\underline{|2}}A_0.$$

$$A_4 = -\frac{(m-2)(m+1)}{4 \cdot 3}A_2 = \frac{m(m-1)(m-2)(m+1)}{\underline{|4}}A_0.$$

$$A_6 = -\frac{(m-4)(m+3)}{6 \cdot 5}A_4$$

$$= -\frac{n(m-1)(m-2)(m-4)(m+1)(m+3)}{\underline{|6}}A_0, \text{ etc.}$$

Thus, since each term involving an even power of x will be multiplied by A_0, which is an arbitrary constant, the series of even powers of x will be equal to a constant multiplied into

$$\phi(x) = \left\{1 - \frac{m(m-1)}{\underline{|2}}x^2 + \frac{m(m-1)(m-2)(m+1)}{\underline{|4}}x^4 - \frac{m(m-1)(m-2)(m-4)(m+1)(m+3)}{\underline{|6}}x^6 + \ldots\right\}.$$

From (1),

$$A_3 = -\frac{m(m-1)}{3 \cdot 2}A_1.$$

$$A_5 = -\frac{(m-3)(m+2)}{5 \cdot 4}A_3 = \frac{m(m-1)(m-3)(m+2)}{\underline{|5}}A_1.$$

$$A_7 = -\frac{(m-5)(m+4)}{7 \cdot 6}A_5$$

$$= -\frac{m(m-1)(m-3)(m-5)(m+2)(m+4)}{\underline{|7}}A_1, \text{ etc.}$$

Thus each term involving an odd power of x will be multiplied by A_1, which is an arbitrary constant, and the series of odd powers of x will be equal to a constant multiplied into

$$\psi(x) = \left\{x - \frac{m(m-1)}{\underline{|3}}x^3 + \frac{m(m-1)(m-3)(m+2)}{\underline{|5}}x^5 - \frac{m(m-1)(m-3)(m-5)(m+2)(m+4)}{7}x^7 + \ldots\right\}.$$

Thus the general solution of the equation takes the form

$$y = A\phi(x) + B\psi(x),$$

where A and B are arbitrary constants.

Puzzled.—The interval between the firing of two guns at a railway station was six minutes, and a passenger in a train approaching the station at a uniform rate heard the second report 5 minutes 51 seconds after hearing the first. Now supposing the sound of the train's approach to have become audible at the station when the train was two miles off, how soon after that did the train pass the station, sound travelling 1125 feet per second? (Colenso's *Arithmetic.*)

Since the interval between the shots as observed by the passenger is nine seconds less than the actual interval, and sound travels 1125 feet per second, the distance covered by the train in the observed 351 seconds was 9×1125 feet. Hence the train's rate is $\frac{9 \times 1125}{351}$ feet per second. The time required to cover 2 miles, or $1760 \times 3 \times 2$ feet, is therefore $(1760 \times 3 \times 2) \div \frac{9 \times 1125}{351}$ seconds = 366·08 seconds, or 6 minutes 6·08 seconds.

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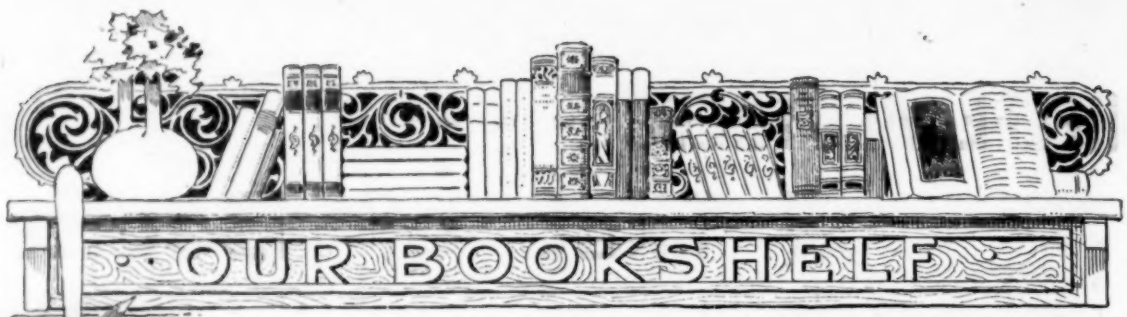

"AT THE SIGN OF THE PAPER-KNIFE."

BY J. EDWARD PARROTT, M.A., LL.D.

MR. YOXALL A-GYPSYING.*

THE old sign swings again after a period of dusty obscurity in the editorial lumber room. It makes its reappearance auspiciously, for its long interrupted creaks are renewed to call the attention of the literary pedagogue to the achievement of one who is rightly regarded as a friend and benefactor by all practical teachers.

Not to know Mr. Yoxall is to argue oneself unknown, and not to be thankful for his eminent services to education is to be guilty of the blankest ingratitude. But here he comes in a new character with the wizard's wand in his hand, and his singing robes about him. He is numbered with the romancers, and his right to stand proudly among them cannot be challenged in the light of the notable book which he has just dedicated to our leisure hours. It is not his first bid for the favour of the circulating library; but that was addressed rather to the narrow circle of his professional comrades. This is his first appeal to the public at large; and I do not hesitate to say that, in my opinion, he has leaped with its publication into the first rank at a single bound.

* * * * *

His new book is as foreign to the world of school as education was to the education debates in the House of Commons. Mr. Yoxall has gone a-gypsying, and he has done it with such a zest and intimate knowledge of the life he portrays that I am almost inclined to believe that, like his Jeruel C. Chilcutt of Delaware, U.S.A., he is not a *gorgio* at all, but a veritable Rommany *chal* in disguise. There is nothing so disconcerting as the unexpected in one's friends, and I am quite at a loss to account for Mr. Yoxall's appearance in this galley. I know the *fons et origo* of his delightful pictures of Derbyshire life; his knowledge of the Derbyshire dialect; his deep insight into the Derbyshire character: for Sharrow Lane is not a hundred miles from the Peak. But when one comes to the gypsying, the mystery of the fly in the amber is repeated. No mere thumbing of a slang dictionary nor assiduous cramming of Francis Gribble and Theodore Watts Dunton could possibly produce this result. Can it be that our quiet, decorous, frock-coated, top-hatted M.P. of literary proclivities has had the *dukker* put on him, and has, in very deed, slipped away in the light of "Old Silver" and followed the *paterin* to vagabondise with the *juwas* and the *Roms* in a snug *tan*? No other theory explains the intimacies of gypsy life here revealed. I grant you that Mr. Yoxall does not look it; but looks are proverbially deceptive.

* * * * *

Mr. Yoxall has not set himself to unravel anything like a tangled skein. His plot is eminently straightforward; indeed it is little more than a series of episodes. Nevertheless, the characterisation is thoroughly good. Indeed, the book everywhere displays the most painstaking and conscientious work. His hero, Matt Scargill, a Derbyshire yeoman, is a full-length portrait admirably painted both by himself and the author. Around him and his beautiful cousin Dahlia the whole plot centres. The two have grown up together, destined by their guardians for ultimate matrimony—a position accepted by Matt with complacency, by Dahlia without enthusiasm. Then comes the handsome gypsy *krallis*, Aldo Lee, with big, dark eyes, and jetty mustachios, a gifted Italian whose fame as a carver brings him to Chatsworth for the purpose of adorning the little Catholic chapel maintained by the duke for his tenants of the old faith. Dahlia and Aldo Lee meet; the girl is fascinated, the man flattered. There is a secret marriage, a hasty flight, and Matt awakes to find that he has loved and lost. Perhaps the finest chapter of the book is that in which Dahlia, in the solitude of the *tan* in which her husband lies hidden, a fugitive from the law which he has violated, reviews the variegated incidents of her four years of married life. She recalls the flame of passionate love that lapped her, the gypsy magic that wiled her, the gypsy passion that held her, the days of luxury in Rome, the loveless wanderings from Italy to London, from London to Ypres, from Ypres to Aachen and Cologne, the jolting wagons, the swaying diligences, the growing contempt for her criminally-minded husband, the streets of Basle, where "license and fanaticism flaunted arm in arm," the grimness of Switzerland in her winter shroud, and then the lovely land of Italy.

> "But Italy! At first the lakeland; white-pointed mountains, some with gold above and sheathed in silver below; rocks that at sunset blushed and sparkled like carbuncle stones, reflected in lagoons of fluid emerald and sapphire; stiff agave, thorny cactus, flat-topped pine, withering lemon grove, brown, palmy cluster—the fading flush of rose-oleanders in the *patio* of an inn where she was happy for a day—that charmed, enchanted hostel of *Lost time*. Then came the piled and tumbled hills, that undulated into the vastness of lonesome heaths, where gaunt, slant crosses told of bygone stabbings unavenged; then plains, where thin, steely curves of water shone like sickles laid late to the fields; where olive-hued canals meandered; where the mulberry neighboured the chestnut and the vine. Lombardy, where in the sordid towns bold beggars swarmed, and shameless hoydens flaunted, and swarthy priests with furtive eyes droned at their greasy breviaries as they passed. From post to post the *velturine*, beating the tortured horses, drove them along, past gorges filled with myrtle, on roads that were lined with crackling elms still garlanded with empty vines. A land of shrines, ossuaries, churches; with calvaries and crosses all along the way. How piously, now that he was in priestly Italy, Aldo had crossed himself at every wayside haunt of prayer! Poplar-bordered brooks, silver-gray olive orchards, battalions of mournful cypress, stript almond trees, red towers of ruinous villas just seen amid gray woods of ilex; white, calm oxen with scarlet headbands under black horns; the coasting road, with the sea on the sunset side; Spezzia, Pisa; and a sunny turquoise sky over all."

* * * * *

Now Dahlia, weary, disillusioned, but still faithful to her marriage vows, watches the Derby road with a beating heart for the Bow Street runners that are on her husband's track with a special warrant; while he, weak and ill, waits the opportunity to hurry north by the drover's path, and so attain the gypsy sanctuary of Kirk Yetholm beyond the border. She is a burden, a danger, a standing menace to his safety; for her beauty is remarkable, and he may be easily traced by her. She must, in the meantime, return to the shelter of her uncle's house—to the neighbourhood of her

* *The Rommany Stone*, by J. H. Yoxall, M.P. 2nd edition. (Longmans, 6s.)

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discarded lover—to the village in which her shameful and secret union with a gypsy is still a theme of village reproach. Accordingly, the *dukker* has been put upon her stalwart cousin Matt Scargill, and willy-nilly, on the shine of the moon, he hies forth to the Rommany Stone on the lonely moor, and there, at the gypsies' post-office, sees that "sore trouble is agait with Dahlia," and that he is "to fare to her quick." "Aldo, the scoundrel, was in double danger: a cross was laid out atop of the stone, with a gallows aside it, all in little sparkling grits of spar. The cross meant sickness, the gallows meant hanging; just what I might have expected for the fellow, dall his eyes!—just what I might have wagered would be his finish. The stem of the cross pointed westerly; then westward I was to goo." Westward he goes to the camp-fire of neighbouring gypsies, and there meets with the Flash Budger, who is to guide him to Dahlia.

* * * * *

The ride to the secret *tan* in which Dahlia hides with her sick husband, the adventures on the road, the encounter with Jeruel C. Chilcutt and his nigger, Pernicus, the meeting with the "redbreasts," who are hunting down the *krallis*, the humours of these worthies, the narrow escape of the yeoman and his companion from arrest as confederates of the Flash Budger, the death of Aldo, and the subsequent happiness of Dahlia and her once-despised lover, are the main incidents in a story which palpitates with life, scintillates with humour, glows with passion, and is everywhere illuminated by descriptive writing that almost beggars praise. Truly Mr. Yoxall has garnered a goodly harvest of the quiet eye. His insight is profound, his experience wide, his imagination fruitful, his gaiety infectious; nevertheless, it is his descriptive writing which awakens the highest admiration.

* * * * *

No bald outline, such as I have attempted to give, can possibly indicate the many virtues of this story. Jeruel C. Chilcutt would alone make the fortune of any book. He is an American who has prospered, and has returned with his negro attendant to seek out and claim acquaintance with the noble family from which he believes himself to be descended—the Chilcutts of Chilcutt Castle. Alas! he, too, is a Rom; he, too, is descended from a gypsy, who "faked a gry," and was sent across the "big bath" in consequence. "Wheer," asks Jeruel C., when the fact is established—"wheer is the fambly berrying-ground? 'Cause I feels jest about ready for thet bit o' prop'ty myself." Nevertheless, Jeruel meets the *jawa* Flamenca—who is, by the way, one of Mr. Yoxall's most delightful characters. In her love he forgets the slings and arrows of the outrageous fortune which has dashed all his fondest hopes to the ground. Jeruel is a typical American; he despises high birth, but longs to claim it. (It is said that the best thumbed book in the Boston Public Library is entitled *Americans of Royal Descent.*) The Bow Street runners, however, supply most of the fooling, and admirable fooling it is.

* * * * *

I remarked, a few paragraphs above, that in this book Mr. Yoxall altogether discards the world of school. The statement is not strictly correct, for one of the subordinate characters, Master Nathan Quince, is a Knight of the Ferule. He is, in addition, "third borough, tything-man, pinder, ale-taster, bell-man, beadle, beggar-banger, barnister, parish-bookkeeper, magistrate's clerk, clerk to the incumbent, ostarius, and petty constable of the parish." This parochial Pooh Bah is a frank caricature, in appearance, in occupation, and in language. Probably he would have described himself as a sesquepedalian conversationalist, for he talks in the following strain when he is lamenting the universal truanting of his scholars to follow with open-mouthed interest the doings of the Bow Street runners and Jeruel's nigger:—

"Never a single juvenile attendant in my Academe," he began, "so puissant is the attraction of metropolitan custodians and a nigrous Ethiopian, tee-hee! My intellects were abstracted in the lexicon, so that I perceived not immediately, or directly, a silence unaccustomed or rare! Howbeits, in the finis, or end, or completion, I elevated my cranium and perambulated my opticals. Verily, my Academe was void—not a singular juvenile attendant! But my ferule hath adequately chastised the peccant, in partibus posteriores, tee-hee! It is probable or apprehendable that their lamentations have resounded in your auditories, excellent gentlemen."

Another well-drawn character is the rector of Stoniton, Owd Lottery, as he is profanely called by the villagers because of his partiality for prize drawings. He is so deeply in debt that he dare not inhabit the rectory, and lives in the vestry, which is his "Refugium," immune from writs. The homily which he writes, with the assistance of rum and water, for the behoof of his shock-headed congregation, is a really clever parody of the kind of thing formerly purveyed by college pedants for rustic edification. In fine contrast with this sordid picture is that of Lawrence Yewdall, one of Wesley's field preachers, and his revival meeting in the Woodseats. Mr. Yoxall's heart and mind have worked in the closest harmony on this theme, and the result is wholly admirable.

* * * * *

Frankly, I am not ashamed to be enthusiastic about this book. Faults it has, like everything else of human production; but, on the other hand, its merits are outstanding. Mr. Yoxall has vindicated his excursion into fiction by achieving success. Every practical teacher will congratulate him, and one, at least, will regret that he has given up to the House of Commons what was clearly meant for a not inconsiderable section of mankind.

NOTES AND JOTTINGS.

GEOGRAPHICAL ASSOCIATION'S ANNUAL MEETING.—The annual meeting of the Geographical Association will be held in London on Friday, 9th January, at 3.30 p.m., in the Hall of the College of Preceptors, Bloomsbury Square, by kind permission of the Council of the College, the president, Mr. Douglas Freshfield, in the chair. An address will be given by the Hon. Sir John Cockburn, K.C.M.G., M.D. (formerly Minister of Education and Prime Minister of South Australia, and chairman of the Australasian Chamber of Commerce, London), on the *Australian Commonwealth*. There will also be an exhibition of examples of all scales and styles of ordnance survey maps, and Mr. Andrews will give a lantern demonstration in connection with the exhibition.

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The Rise of Wellington. By Field-Marshal Earl Roberts, V.C., K.G. This masterly account of Wellington's military career has been issued in a cheap form with paper covers. It was not written for boys, and may, perhaps, be rather too technical for them—although the modern boy reckons that his knowledge of things military is something remarkable. So the objection is a small one, and will not deter the juvenile reader from being thrilled by the account of the heroic devotion to duty of the Iron Duke and the brave men who served under him.

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Caesar: Civil War. Book I. By A. H. Allcroft, M.A. We have tested this edition with considerable thoroughness, and have invariably found it practical and sound.

We found only one note that seemed really liable to objection, and that is on page 71, where the editor, commenting on the words, "neque iis.....persuaderi," says: "*Persuadeo*, being an intransitive verb, can be used impersonally only in the passive." This seems to us to be neither accurate nor necessary. *Persuadeo* means "I recommend," and its construction is an accusative of the thing recommended and a dative of the person to whom the thing is recommended. For example, *Persuadet Gaio ut abeat*, "He recommends that he should go away" (accusative of direct object) "to Gaius" (dative of indirect object). When put into the passive form, this quite naturally becomes, *Ut abeat* (that he should go away) *persuadetur* (is recommended) *Gaio* (to Gaius). The construction is quite normal and simple, and requires no such machinery as "impersonally used in the passive" to explain it.

We also object to the description of Pompeius as "wiping out the pirates in forty days."

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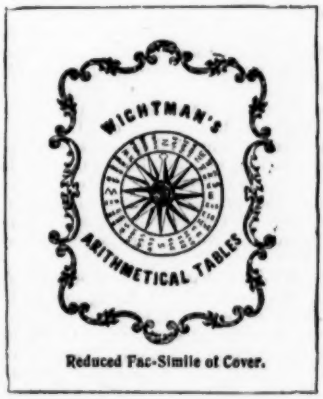

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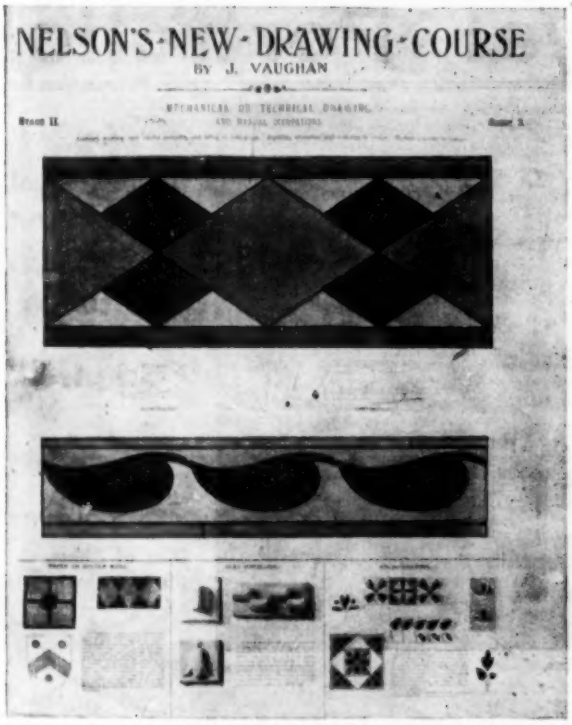

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